International perspectives on streamlining local-level information for sustainable forest management

A selection of papers from a conference held in Vancouver, Canada, August 28 and 29, 2000

Edited by John L. Innes, Gordon M. Hickey, and Bill Wilson

Natural Resources Canada • Canadian Forest Service
Pacific Forestry Centre • Victoria, British Columbia
Information Report • BC-X-400

Natural Resources Canada
Ressources naturelles Canada
Canada

The Pacific Forestry Centre, Victoria, British Columbia

The Pacific Forestry Centre of the Canadian Forest Service undertakes research as part of a national network system responding to the needs of various forest resource managers. The results of this research are distributed in the form of scientific and technical reports and other publications.

Additional information on Natural Resources Canada, the Canadian Forest Service, and Pacific Forestry Centre research and publications is also available on the World Wide Web at: **www.pfc.cfs.nrcan.gc.ca**. To download or order additional copies of this publication, see our online bookstore at: **bookstore.cfs.nrcan.gc.ca**.

International perspectives on streamlining local-level information for sustainable forest management:

A selection of papers from a conference held in Vancouver, Canada, August 28 and 29, 2000

Edited by

John L. Innes and Gordon M. Hickey
Sustainable Forest Management Laboratory
Department of Forest Resources Management
Faculty of Forestry, University of British Columbia
Vancouver, Canada.

and

Bill Wilson
Industry, Trade and Economics
Pacific Forestry Centre
Natural Resources Canada, Canadian Forest Service
Victoria, Canada.

Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria BC V8Z 1M5

Information Report BC-X-400

2004

Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, British Columbia
V8Z 1M5
Phone (250) 363-0600

www.pfc.cfs.nrcan.gc.ca

© Her Majesty the Queen in Right of Canada, 2004

ISSN 0830-0453
ISBN 0-662-38344-3

Printed in Canada

Microfiches of this publication may be purchased from:

MicroMedia Inc.
240 Catherine Street, Suite 305
Ottawa, ON K2P 2G8

Library and Archives Canada Cataloguing in Publication

International perspectives on streamlining local-level information for sustainable forest management: a selection of papers from a conference held in Vancouver, Canada, August 28 and 29, 2000.

(Information report, ISSN 0830-0453; 400)
Includes bibliographical references.
ISBN 0-662-38344-3
Cat. no. Fo143-2/400E

1. Sustainable forestry - Congresses.
2. Forest management - Congresses.
I. Innes, John L.
II. Hickey, Gordon M.
III. Wilson, Bill.
IV. Pacific Forestry Centre.
V. Title.
VI. Title: Streamlining local-level information for sustainable forest management.
VII. Series: Information report (Pacific Forestry Centre); BC-X-400.

SD387.S87I57 2004 333.75'15 C2004-980322-0

Acknowledgements

The participation of many authors and reviewers has made this report possible and their time and cooperation is appreciated.

Special thanks must also go to the British Columbia Ministry of Forests, Weyerhaeuser Canada, Forest Alliance British Columbia, Lignum Ltd., Natural Resources Canada and the Canadian Forest Service for their financial contributions to the conference "Streamlining Local-level Information for Sustainable Forest Management" held by the Faculty of Forestry at the University of British Columbia on August 28 and 29, 2000.

Abstract

The world's forests have an impact on atmospheric conditions, species extinction, soil condition, water quality, landscape diversity, aboriginal communities and the economic well-being of nations. It is commonly acknowledged that these are just some of the problems associated with sustainable development that need to be addressed by the international community. The rates of change in indicators designed to monitor human progress toward sustainable forest management will be directly affected by human population characteristics, socio-economic demands and the value systems associated with forest resources in a particular country. Although historically the term "forestry" was primarily concerned with timber production, today it involves the management of multiple values, from recreational opportunities to the preservation of wildlife habitats.

This report aims to facilitate the exchange of information on sustainable forest management. The report presents stakeholder perspectives from a range of geographic locations on sustainable forest management information issues at the local, national and international level. Many of these manuscripts were submitted to the conference "Streamlining Local-level Information for Sustainable Forest Management" held by the Faculty of Forestry at the University of British Columbia in August, 2000. This report is not intended to be conference proceedings; hence not all submitted manuscripts have been included. It presents a selection of papers that describe information issues associated with sustainable forest management in a range of jurisdictions.

Résumé

La forêt a un impact sur le climat, la survie des espèces, la qualité du sol et de l'eau, la diversité du paysage, les conditions de vie des communautés autochtones et le bien-être économique des nations. Ce ne sont là que quelques aspects de la problématique du développement durable sur lesquels doit se pencher la communauté internationale. Les caractéristiques des populations humaines, les pressions socio-économiques et la nature des rapports qu'entretient un pays donné avec son patrimoine forestier auront une incidence directe sur le rythme du changement qu'on observera dans les indicateurs établis pour mesurer les progrès accomplis par l'homme dans la gestion durable des forêts. Si le terme «foresterie» a de tout temps été associé à l'industrie du bois, il englobe aujourd'hui la gestion de plusieurs fonctions, depuis les activités de loisir jusqu'à la préservation des habitats fauniques.

Ce compte rendu a pour objet de faciliter l'échange d'information concernant la gestion durable des forêts. Il présente le point de vue d'acteurs provenant de diverses régions géographiques sur les problèmes d'information qui existent en matière de gestion durable des forêts à l'échelle locale, nationale et internationale. Plusieurs des articles en question ont été soumis à la conférence intitulée Streamlining Local-level Information for Sustainable Forest Management, organisée par la faculté de foresterie de l'université de la Colombie-Britannique en août 2000. Il ne s'agit pas ici des actes de la conférence non plus qu'un compte rendu de la totalité des articles soumis. Ce rapport présente plutôt une sélection d'articles portant sur les problèmes d'information associés à la gestion durable des forêts qui existent dans diverses régions.

Contents

Acknowledgements iii
Abstract / Résumé iv

Background

Streamlining local-level information for sustainable forest management 1
Tom Neiman, John L. Innes

International Perspectives on Forestry-Related Information

Sustainable Forest Management: The Application of Criteria and Indicator Measurements in the United States Forest Service 17
Albert Abee

Data Collection and Auditing of Sustainable Forest Management in Finland 31
Hanna Nikinmaa

Criteria and Indicators for the Sustainability of Non-timber Forest Products and Services at the Local Level: A Case Study at the Haliburton Forest & Wild Life Reserve Ltd. Ontario 53
Thorsten Mrosek, David Balsillie

Sustainable hardwood supply in the Republic of Korea 69
Woo-Kyun Lee

A linear programming approach to evaluating criteria and indicators for sustainable forest management in Japan 83
Takuya Hiroshima

Inclusion before Streamlining: The Status of Data Collection on Aboriginal Issues for Sustainable Forest Management in Canada 94
Peggy Smith

Conclusions

Streamlining planning and reporting for sustainable forest management 105
John L. Innes, Bill Wilson, Gordon M. Hickey

105-01524/

Streamlining local-level information for sustainable forest management

Tom Niemann

Forest Practices Branch, British Columbia Ministry of Forests
PO Box 9513 Stn Prov Govt, Victoria, British Columbia, Canada V8W 9C2

John L. Innes

Department of Forest Resource Management, Faculty of Forestry, University of British Columbia
Forest Sciences Centre, 2045, 2424 Main Mall, Vancouver, British Columbia, Canada V6T 1Z4

Abstract

Sustainable forest management is a relatively new term in forest policy. Several international, national and non-governmental initiatives have attempted to define it, typically with a number of principles or goals, supported by criteria and indicators that are used to assess if a forest is being managed sustainably. In this background paper, three groups of initiatives that strive to ensure sustainable forest management are reviewed: criteria and indicators, forest certification, and land-use and resource planning. Overlaps and linkages between initiatives suggest opportunities for more efficient and effective collection and management of local-level information used for indicators in all three initiatives. The role and relevant types of monitoring are reviewed, along with factors to consider in the selection of indicators. Major challenges in achieving efficiencies within and across the three initiatives are proposed: working towards convergence of information requirements, streamline procedures to avoid duplication of effort, improving information management and information tools, and sharing responsibilities in an effective and equitable manner.

Keywords: *Sustainable forest management, criteria and indicators, forest certification, land use and resource planning.*

Introduction

Widespread concern that forests be managed sustainably has resulted in numerous, often overlapping efforts to ensure sustainable forest management (SFM). This paper provides an overview of the definition of SFM and three major groups of initiatives that strive to ensure SFM at local, national and international levels. It then reviews the role of local-level information that supports SFM, and proposes a number of challenges that should be addressed to improve the efficiency and effectiveness of collecting and managing this information. In this document, "local" is used to refer to small and large forest management units such as individual watersheds, tenures (e.g. woodlot licences, tree farm licences), administrative areas (e.g. timber supply areas, forest districts) and planning areas (e.g. land and resource management planning areas).

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

Sustainable forest management

Sustainable forest management is a term that has become widely used in a variety of contexts. In many cases, claims that forests are being managed sustainably are questionable. One of the principal reasons is the difficulty of defining the term, and the many different definitions that exist. The range of definitions currently used, together with the continuing uncertainty over measures of sustainability, mean that there is considerable latitude in the use of the term. Consequently, what may be considered by one group to constitute SFM may not be accepted by another group.

Several international sources provide definitions. Dunster and Dunster (1996) define SFM as "forest management regimes that maintain the productive and renewal capacities, as well as the genetic, species and ecological diversity of forest ecosystems." According to Helms (1998), SFM is an evolving concept with several definitions: "1) the practice of meeting the forest resource needs of the present without compromising the similar capability of future generations—note sustainable forest management involves practicing a land stewardship ethic that integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and aesthetics (UNCED 1992); 2) the stewardship and use of forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfil, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems (Second Ministerial Conference 1993)". Sustainable Forest Management is thus a term that refers to meeting the needs of the present while ensuring the long-term availability of forest values in the future.

Canada's National Forest Strategy 1998–2003 (CCFM 1998) states a goal for sustainable forests that amounts to a definition of sustainable forest management: "Our goal is to maintain and enhance the long-term health of our forest ecosystems, for the benefit of all living things both nationally and globally, while providing environmental, economic, social and cultural opportunities for the benefit of present and future generations." Although the focus is on forest health, the concept of a holistic approach to forest management that involves both the present and the future is clear.

Common to most definitions of SFM is the achievement of current environmental, economic and social goals for a forested area, without impairing either future interests or other ecosystems. While a precise definition of SFM may be elusive, this should not delay steps to improve current forest management practices where necessary. As Ljungman *et al.* (1999) state: "Lengthy pursuit of a consensus definition of sustainable forest management is probably more of an impediment towards implementation than any limitation in our understanding of the ecological and social functions of forests."

Numerous related concepts either sound similar to SFM or constructively assist in the achievement of SFM. Sustained yield forestry is a more limited concept, primarily concerned with sustainable production of timber and with little attention being paid to other environmental or social values. Sustainable forest development requires SFM (Dunster and Dunster 1996), and is almost synonymous, but implies active changes to the forest resource. Sustainable development is, however, far broader than SFM, encompassing forestry and all other sectors. Integrated resource management (IRM) is a precursor of SFM that emphasized consideration of all natural resources, but did not emphasize ecosystem integrity and interactions with social systems, although more recent definitions of IRM and integrated watershed management do (Heathcote 1998; Helms 1998). Ecosystem management emphasizes the interaction of environmental, economic and social systems (Boyce and Haney 1997; Meidinger 1997; D'Eon *et al.* 2000) and, when applied in forests, is largely synonymous with SFM, although some would argue that it is simply one of many forms of management that can be undertaken within the framework of SFM. Adaptive management is a more specific tool for scientific experimentation on an operational scale (Holling 1978; Walters 1986) that can assist in achieving SFM if used correctly. Environmental management systems can focus operations towards SFM with a cycle of continuous improvement, laid out in the ISO 14000 series (Barrow 1999; ISO 2000). Land-use planning is a necessary basis for SFM, and public participation helps to ensure fuller consideration of social aspects. Sustainable forest management is philosophically rooted in the concepts of forest stewardship, ecological stewardship and the land ethic, which emphasize caring for the land and conserving natural values. Sustainable forest management incorporates many utilitarian, anthropocentric concepts and more biocentric perspectives, e.g., that ecosystem, species and genetic diversity must be maintained even if no utilitarian value is apparent.

Despite these difficulties, or maybe because of them, sustainable forest management has become a fashionable term that is widely used but often lacks the support of rigorous science. This is unfortunate, as there is growing pressure on forest managers to demonstrate that they are managing the forests for which they are responsible in a sustainable fashion. In so doing, they will need to be more transparent than hitherto, with any assumptions that they make being documented and tested and all results being submitted for rigorous review and auditing.

Sustainable forest management initiatives

Governments, forest industry associations and other non-government organizations have developed a variety of initiatives with the intent of ensuring SFM. Despite the common intent, numerous significant differences persist due to different perspectives, areas of emphasis, and definitions of SFM. The initiatives generally fall into one of three main groups: 1) criteria and indicators, with emphasis on monitoring (at the national level, but increasingly also at the local level), 2) forest certification, with emphasis on management systems and performance (at the forest management unit level), and 3) planning, with emphasis on allocating land and resources to various uses (at local and higher levels).

Various initiatives operate at different scales— international, national, provincial and local— with some spanning all levels.

International initiatives

Global concern about the environment led to a series of agreements at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro. These agreements, often known as the "Rio cluster", included:

1. Agenda 21;
2. the Rio Declaration;
3. the Convention on Biological Diversity;
4. the Framework Convention on Climate Change; and
5. the Forest Principles (the non-legally binding authoritative statement of the principles for a global consensus on the management, conservation and sustainable development of all types of forests).

Much of the basis for these agreements was laid out by the 1987 Brundtland Commission, which defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Agenda 21 is an action plan for sustainable development in the 21st century. The Rio Declaration is a set of non-binding principles to guide the course of human development. The two conventions support aspects of SFM, while the Forest Principles define SFM in broad terms.

Following the 1992 UNCED meeting, a number of international groups have continued to develop the basic principles associated with the sustainable management of forests, most notably the World Commission on Forests and Sustainable Development (WCFSD 1999) and the UN Commission on Sustainable Development through the Intergovernmental Panel on Forests, Intergovernmental Forum on Forests and UN Forum on Forests. Despite the efforts to reach international agreement, there is still no global convention dealing specifically with forests, although a legal instrument for forests continues to be a subject for international discussions.

The Center for International Forestry Research (CIFOR) has worked in several locations around the world to develop a set of criteria and indicators of SFM, including the North American Test in forests adjacent to Boise, Idaho, in 1998. CIFOR has also developed a computer software package designed to help users modify, customize and adapt its generic template of criteria and indicators to meet local conditions and expectations (CIFOR 1999). The results of this work have been applied most successfully in developing countries, where the focus has been on issues such as poverty alleviation, equitable sharing of benefits derived from forests, use of traditional forest-related knowledge and other activities specific to those countries.

Eight international agreements covering various parts of the globe provide criteria and indicators for monitoring and reporting on SFM at the national level by the participating nations. Two are relevant to temperate and boreal forests: the Helsinki Process, subsequently re-named the Pan-European Process, and the Montreal Process, which covers non-European temperate and boreal forests. The 12 Montreal Process countries cover a much larger area than those in the Pan-European Process, encompassing 90% of the world's temperate and boreal forests and 60% of all forests.

Three international systems of forest certification provide formal, independent assessments of how well forests are managed to assure customers that products come from sustainably or well-managed forests. The International Organization for Standardization (ISO), a worldwide federation of national standards bodies from some 130 countries, developed certification of environmental management systems for all industrial sectors, that comply with specifications (ISO 14001) and guidelines (ISO 14004), with additional information for application in the forest sector (ISO 14061) (ISO 2000). The Forest Stewardship Council (FSC), established in 1993, has developed a worldwide system of forest-area certification and product labelling based on one international set of 10 principles and a number of interpretive "criteria" (FSC 2000). These have been further elaborated into prescriptive standards developed for some forest regions and by various accredited certifiers (the Scientific Certification Systems (Forest Conservation Program, 1995), Rainforest Alliance (SmartWood Program, Generic guidelines for assessing natural forest management, 1993), Soil Association Marketing Company Ltd. (Responsible Forestry Programme, 1994), SGS Forestry (Qualifor, 1992), Institut für Marktökologie (IMO), Skal, KPMG, and Silva Forest Foundation (1994 and 1998, accredited in 2000). Most environmental non-government organizations consider FSC to have the only credible forest certification system, in part because it certifies a chain of custody from the forest to the retailer and includes product labelling. However, dissatisfaction with the Forest Stewardship Council certification process, cost and requirements prompted the formation of the Pan-European Forest Certification (PEFC) system in 1998, based on mutual recognition of national certification systems that comply with the criteria of the Pan-European Process (PEFC 2000).

Alternatives to forest certification have been promoted by some environmental non-government organizations, such as the scorecard system used by the World Wide Fund for Nature (WWF, http://www.panda.org/downloads/forests/Report_Jan2000.doc). However, certification is now the most widely accepted method to assess the management of a particular forested area.

International planning initiatives are sometimes established for resource issues that cross national boundaries, which is often the case in major watersheds. The historical focus on flood control and water supply (on the Columbia River, for example) and water quality (on the Great Lakes) is gradually expanding to address SFM issues such as ecosystem (habitat) distribution and viable populations of threatened species (e.g. U.S. Department of Agriculture, Forest Service 1996). However, the Columbia Basin initiative remains a purely U.S. project and does not involve Canada. To be effective, such initiatives should involve the whole ecological unit and should not be limited by political boundaries.

National initiatives

The international policy dialogue has provided a stimulus and framework for individual countries to pursue national strategies for SFM. In Canada, the National Forest Strategy (Sustainable Forests: A Canadian Commitment (1992-1998)) was the first national forest strategy to emphasize SFM rather than timber. "The Strategy was instrumental to Canadian representations at the 1992 United Nations Conference on the Environment and Development (UNCED), which resulted in the Forest Principles, and afterwards in addressing all relevant forest-related commitments stemming from the UNCED" (CCFM 1998). However, implementation of this strategy has been varied, and an emphasis in the most recent version (CCFM 2003) is on the effective implementation of the strategy.

Another important strategy document was the Canada Forest Accord of 1992, re-affirmed in 1998 and 2003 by many signatory groups. Interestingly, the Forest Accord's central goal refers to the maintenance and long-term health of Canadian forest ecosystems, yet the concept of forest health has been one of the most difficult to apply within the context of criteria and indicators (Simberloff 1999; Innes and Karnosky 2000). Again, implementation of this accord has not been as complete as was initially hoped.

As part of the national strategy, the Canadian Council of Forest Ministers (CCFM) developed a set of criteria and indicators relevant to Canada (CCFM 1995). This set of criteria and indicators is similar, but not identical, to the criteria and indicators agreed upon in the Montreal Process. Canada's capacity to report on the criteria and indicators was examined in a technical report (CCFM 1997). The first full report on the criteria and indicators was published in 2000 (CCFM 2000). They have since undergone a significant revision process, with a new set of indicators published in 2003.

In many countries, the implementation of the philosophy espoused in the international agreements has been slow. One example of how the policy dialogue can be extended to national policy and subsequently to on-the-ground forest management is provided by the United Kingdom. The 1996 UK Forestry Accord identified six guiding principles:

1. investment in sustainable forestry of all types should be strongly encouraged;
2. conservation of biodiversity and natural resources should lie at the heart of forest management;
3. forest management should safeguard and enhance landscape and heritage values;
4. sustainable, productive forestry to provide timber benefits should be encouraged;
5. research, education and training should cover all aspects of sustainable forestry; and
6. the public should be widely involved in and consulted on forestry matters.

This policy document evolved into the UK Forestry Standard (Forest Authority 1998), a document that sets out the criteria and standards for SFM in the UK. The standard is designed to link to the emerging international protocols and is also intended to form the basis for forest monitoring and forest certification systems. A number of issues are identified and defined, and indicators applicable at the forest management unit are specified. The list is broadly consistent with the criteria and indicators of the Pan-European Process, but has been adapted to the British situation.

National forest certification systems have been developed by non-government organizations in Canada, the United Kingdom, Finland, Sweden, Norway and several other countries. At the request of the Canadian Pulp and Paper Association, as it then was, the Canadian Standards Association (CSA) developed a national Canadian standard for certification of forest management based on the ISO environmental management system and the CCFM's criteria and sub-criteria called elements, leaving the selection of indicators to the applicant, working in cooperation with the local public (CSA 1996). In the UK, the Woodland Assurance Scheme has implemented a certification system based on the UK Forestry Standard. In marked contrast to the Canadian standard, the UK Woodland Assurance Scheme has been recognized by the Forest Stewardship Council. It has also achieved endorsement by the PEFC.

In the United States, the American Forest and Paper Association (AF&PA) has developed the Sustainable Forestry Initiative. This was initially an industry-led process, but since the formation of the Sustainable Forestry Board, it has become a multi-stakeholder process, with the standard-setting being done independently of the AF&PA. Members of the AF&PA are required to achieve Sustainable Forestry Initiative (SFI) certification, and several Canadian companies, including a number in British Columbia, have also achieved this form of certification.

National planning initiatives address various aspects of SFM, such as the national plan for protected areas that are representative of major biomes, along with protecting special features and landscapes. Canada's National Forest Strategy is being implemented with a comprehensive action plan that covers a wide range of activities by federal, provincial and territorial governments, the forest industry and other signatories to the Canadian Forest Accord.

Provincial initiatives

The Canadian provinces have adopted various strategies, including provincial sets of criteria and indicators and policies to incorporate them in forest management planning (Montreal Process 1995). Quebec amended its Forest Act to include the six CCFM criteria and developed a set of 60 indicators largely similar to those of the CCFM. Ontario also drafted a set of indicators for use at the provincial level and integrated criteria and indicators into forest legislation and policy. In New Brunswick, policy goals for SFM were set out, supported by explicit standards and objectives for forest management plans. In British Columbia, concepts of SFM are central to the new Forest and Range Practices Act, 2002.

The Forest Stewardship Council established three provincial/regional processes [British Columbia, Great Lakes-St. Lawrence (Ontario), Acadian (Maritime Provinces)] to develop regional standards and is working towards one for Canada's boreal forests. These tend to be prescriptive rather than simply being lists of indicators. The Alberta Forest Products Association developed FORESTCARE, a system to evaluate and communicate its members' improvements toward SFM, with the help of comprehensive, independent audits (AFPA 2000). After a considerable delay, the British Columbia regional standard of the Forest Stewardship Council has achieved provisional endorsement from the national organization, and the final difficulties are now being examined in a series of trial certifications.

Numerous provincial planning initiatives address aspects of SFM or provide a land-use basis for SFM. Examples include the land and resource management planning process in British Columbia and the Lands for Life program in Ontario.

Local initiatives

The Canadian Forest Service is responsible for the administration of a series of model forests in Canada and elsewhere. A national network of local projects is developing processes for SFM at the local level, using partnerships between the forest industry, governments and local stakeholders. The model forests were specifically tasked with selection of local indicators of SFM and testing their use in management processes such as scenario planning. The work on indicators is at varying stages of development, with some model forests being more advanced than others.

In British Columbia, numerous local initiatives are working at a variety of geographic scales to implement better forestry, and in some cases SFM, with the help of indicators, including the Enhanced Forest Management Pilot Projects, Innovative Forestry Practices Agreements and community forest tenures (Innes 2003).

Planning for various aspects of SFM occurs in British Columbia at several levels of land and resource management. On Crown land, strategic plans, developed in processes that strive for consensus, include regional plans and sub-regional land and resource management plans (LRMPs), and cover the largest areas. These are followed by local resource use plans (LRUPs) for selected smaller areas with special resource management issues, and landscape unit plans (LUPs) to systematically address biodiversity. Operational plans typically cover smaller areas, address more specific needs, and are developed in processes that provide opportunities for public input but do not strive for consensus. These include watershed assessments, access management plans, forest development plans, recreation management plans, and community planning for visual-quality objectives.

Allowable cut determinations, which provide a basis for much of the detailed forest planning, take into account many environmental, economic and social factors. Tree farm licences, which typically consist of Crown and private land, require strategic-level management plans that address sustained yield issues and could also address SFM concerns.

Private land planning includes zoning in regional and community plans and growth strategies, and the Forest Land Reserve which emphasizes ongoing use of land for forest values.

Terminology

The terminology associated with the criteria and indicators of sustainable forest management is complex. Maini (1993) proposed a hierarchical classification in which objectives and principles lead to criteria, guidelines and indicators. Lammerts van Bueren and Blom (1997) have developed the classification further, arguing that the overall goal of SFM is supported by a vertical hierarchy of principles (fundamental rules for action), criteria (desired conditions resulting from adherence to principles), indicators (quantitative or qualitative parameters of a criterion) and related norms (threshold or target values of an indicator). They conclude that this framework can be used for any spatial level, although the formulation of some criteria and indicators will vary depending on the level. Other terms used by various initiatives include values, goals (other than the overriding goal of SFM), elements, issues, strategies, verifiers, validators, benchmarks, and trigger points.

Much of the terminology is used inconsistently by the various SFM initiatives and is often not applied consistently within an individual initiative. Different terms are used synonymously in different initiatives. Individual terms are given different meanings and assigned to different functional levels in the hierarchies used by different initiatives. It is unlikely that the various initiatives will attempt to harmonize their use of specific terms. To avoid confusion, it is therefore essential that every initiative and every independent document define all terms used.

Fortunately, the term indicator is used fairly consistently by all initiatives, as defined above. However, some initiatives, e.g., the CSA's SFM system for certification, insist that indicators must be measurable (quantitative).

Overlaps and linkages

Since the various initiatives share the common overriding goal of SFM, one might expect substantial overlaps between various SFM initiatives at each level and clear linkages from international to national, provincial and local initiatives. As noted above, SFM initiatives also have implicit links to other initiatives such as the international conventions on biodiversity and climate change.

Table 1. Comparison of the criteria adopted by three sustainable forest management initiatives

CCFM	Montreal Process	Pan-European (Helsinki) Process
Conservation of Biological Diversity	Conservation of biological diversity	Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems
Maintenance and enhancement of forest ecosystem condition and productivity	Maintenance of productive capacity of forest ecosystems	Maintenance of forest ecosystem health and vitality
	Maintenance of forest ecosystem health and vitality	
Conservation of soil and water resources	Conservation and maintenance of soil and water resources	Maintenance and encouragement of protective functions of forests (wood and non-wood)
		Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water)
Forest ecosystem contributions to global ecological cycles	Maintenance of forest contribution to global carbon cycles	Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles
Multiple benefits to society	Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies	Maintenance of other socio-economic functions and conditions
Accepting Society's responsibility for sustainable development		
	Legal, institutional and economic framework for forest conservation and sustainable management	

Source: (Canadian Council of Forest Ministers 1995, Montreal Process 1995, Ministerial Conference 1994).

Several initiatives have similar, but not fully overlapping criteria for application at the national level, as illustrated in Table 1, which compares the criteria adopted by the Canadian Council of Forest Ministers, the Montreal Process and the Pan-European Process. Currently, there are no major pressures to globally harmonize the different sets of criteria and indicators adopted by the international initiatives, although convergence at the national level is viewed as desirable (FAO 1995). The national-level criteria in Table 1 do not compare as readily with the FSC's principles, listed in Table 2, in part because the latter provide more explicit direction for local-level management. The UN Food and Agriculture Organization now intend to determine how compatible these different initiatives are, although no report will be available until well into 2001.

Table 2. The 10 principles of the Forest Stewardship Council, revised February 2000.

Number	Principle
1	COMPLIANCE WITH LAWS AND FSC PRINCIPLES. Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.
2	TENURE AND USE RIGHTS AND RESPONSIBILITIES. Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.
3	INDIGENOUS PEOPLES' RIGHTS. THE LEGAL AND CUSTOMARY RIGHTS OF INDIGENOUS PEOPLES TO OWN, USE AND MANAGE THEIR LANDS, TERRITORIES, AND RESOURCES SHALL BE RECOGNIZED AND RESPECTED.
4	COMMUNITY RELATIONS AND WORKER'S RIGHTS. Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.
5	BENEFITS FROM THE FOREST. Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.
6	ENVIRONMENTAL IMPACT. Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.
7	MANAGEMENT PLAN. A management plan—appropriate to the scale and intensity of the operations—shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.
8	MONITORING AND ASSESSMENT. Monitoring shall be conducted—appropriate to the scale and intensity of forest management—to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.
9	MAINTENANCE OF HIGH CONSERVATION VALUE FORESTS Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.
10	PLANTATIONS. Plantations shall be planned and managed in accordance with Principles and Criteria 1–9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

Source: Forest Stewardship Council (2000).

Indicators and information used may vary between the national, provincial and local levels. For example, carbon modeling indicators used at the national level may not be relevant at the local level, while availability of habitat and current local populations of a particular threatened species may be important additional indicators at the local level. An indicator of threatened species may consist of quite different lists of species at each level, due to different knowledge bases, priorities and responsibilities (Lautenschlager *et al.* 2000). This suggests that linkages between the levels are not always direct, and that a simple "rolling up" of information from local to national levels may not work for some indicators. Care is therefore required to minimize duplication of effort by the various levels while ensuring that the needs of each level are met.

Local-level information for sustainable forest management

At the local level, monitoring of a selected group of indicators is the basis for assessing the impacts of management activities, and is therefore common to most SFM initiatives, whether focused on reporting of criteria and indicators, forest certification or planning. This section reviews the purposes and types of monitoring relevant to SFM, examines how indicators are selected, and highlights some concerns.

Observation of all entities that may or may not be affected by a particular management activity, to determine whether it is consistent with sustainable forest management, is potentially an enormous task due to the general nature of the criteria of SFM and the large number of potential indicators. Mulder *et al.* (1999) rightly criticize many environmental monitoring proposals in that they "are discussed in abstract terms, have little theoretical foundation, try to measure too many attributes, have vague objectives and have no institutionalized connections to the decision process." Consequently, there have been moves to identify indicators that may be more useful than others, and there have also been attempts to focus on groups of indicators that can be directly related to SFM (e.g., Haynes *et al.* 2000).

As a result of these concerns, there have been a number of developments in the concepts that underlie monitoring. For example, Lee and Bradshaw (1998) identify the principal role of monitoring as being to enlighten decision making by managers. They argue that monitoring achieves this in three ways:

a. by providing an accurate assessment of the status of the resources being managed;

b. by validating that management decisions are correctly interpreted and implemented; and

c. by providing improved insight into how systems operate.

Types of monitoring

Several different types of monitoring exist (Noss and Cooperrider 1994). Within the current context, four are important: background, compliance, effectiveness and validation monitoring.

Background monitoring, as the name implies, provides the setting against which changes induced by management activities can be determined. It ensures that any observed changes are not due to natural or other exogenous processes. Ongoing changes in the environment and localized disturbances such as tornadoes, droughts and fires affect a forest's spatial mosaic of patches and the composition within patches over time. Changes occur on various scales: both spatial and temporal (Innes 1998). Some of the changes are natural in origin, others are due to broad human impacts beyond the control of a forest manager, e.g., increasing atmospheric carbon dioxide concentrations and climate change. While unable to do much about such changes, a manager must be aware of the changes and take them into account in management and in monitoring.

Compliance monitoring addresses compliance with law and compliance with policies and plans of an organization or company, including the requirements of certification systems. Monitoring the degree of adherence to law, including international agreements, federal, provincial and regional regulations is a cost of implementation of the law. Where monitoring shows poor compliance with regulations, enforcement becomes a further cost. Compliance monitoring is an important requirement for certification. It is the basis of the ISO 14001 standard, and is a basic requirement for FSC certification (Principle 1).

Effectiveness monitoring is perhaps most important, yet is often the area that is least well completed (Mulder *et al.* 1999). No management action can be judged successful without monitoring its effectiveness in producing desired outcomes. Recommendations regarding possible changes in management actions also depend on effectiveness monitoring, making it a critical step in adaptive management. The success of effectiveness monitoring depends on the choice of appropriate indicators and the development of a thorough plan that identifies conditions and methods of information collection, addresses logistical and statistical problems, ensures coordination of participants, and applies appropriate predictive models (Madsen *et al.* 1999).

Validation monitoring is used to confirm the accuracy of scientific models and assumed links between cause and effect. For example, it could be used to calibrate growth and yield models, and to check the assumption that provision of habitat will ensure viable populations of wildlife. Validation monitoring is normally done in conjunction with effectiveness monitoring, and the two types may even be combined, especially in the controlled-experiment form of adaptive management.

Selection of local indicators

The selection of indicators is a critical step, and is often problematic. In many cases, lists of indicators simply represent the special interests of those involved in the selection process. They are often of questionable applicability and their relevance to sustainable forest management may also be doubtful. Essentially, indicators should have the following attributes (Smith *et al.* 1999):

1. Easy to measure
2. Cost effective
3. Accommodate changing conditions (e.g. time, stand age)
4. Scientifically sound and based on functional ecological, economic or sociological relationships
5. Forest-ecosystem specific, yet able to be 'scaled up'
6. Integrative of system functional relationships
7. Related to management goals or values.

Once selected, it is important to determine the reliability of the indicators and their potential use. In addition, the research needed to improve apparent shortcomings should be identified. This has been done quite successfully for sub-national indicators in Australia (Anon. 1998), where indicators have been assessed systematically on the basis of rationale, issues, data availability, methods, interpretation and research and development needs. An important aspect of indicator selection is the understanding of the processes that each indicator indicates. In many cases, these processes are poorly understood and a research element is required to determine the optimal way forward. As understanding of a phenomenon increases through research, the costs of monitoring it decline as indicator selection can more precisely target the key processes affecting the phenomenon. Another important point is that most indicator sets are designed to be used as a whole, as specifically stated in the Santiago Declaration (which formally launched the Montreal Process criteria and indicators). Use of only a subset of indicators may lead to difficulties, as some aspects of SFM may not be adequately assessed.

In addition to being scientifically valid, indicators increasingly need to be socially acceptable and, in the litigious North American environment, legally defensible. This suggests that the process for indicator selection, and the selection of participants in that process, may be as important as the indicators themselves. All participants must be fully aware of the strengths and limitations of particular indicators. This presents a problem for some standards, such as the CSA Z809 standard advocated as "the Canadian Standard" for certification. In this, the indicators are chosen by local advisory groups, who are not necessarily well-versed in the fine points associated with the interpretation of particular indicators.

Finally, knowing whether the indicators selected are both necessary and sufficient is problematic. Budgetary constraints often set arbitrary limits that encourage some desirable discipline in the selection process but, if too constraining, may result in a list of indicators that is inadequate for assessing SFM and therefore undermines confidence in management choices.

Local-level information issues

Criteria are essentially political statements that express the desires of a particular constituency. Translating these into actions can be very difficult, especially as the language used in the criteria may be deliberately vague as a result of seeking compromise during the drafting. For example, while a goal may be to maintain ecosystem integrity, what exactly does this mean? In addition, there may be problems of scale: both temporal and spatial. Should ecosystem integrity be maintained continuously across the entire management area (thereby precluding forestry operations), or should it be restricted to those ecosystems of greatest concern? Can short-term integrity be disrupted (e.g. by harvesting) as long as the long-term integrity is not jeopardized? Such questions are rarely asked, although Kimmins (1997) raises many of the issues. Instead, it is left to the manager to decide how to implement the materials.

Budget pressures and decentralization are increasing pressures to devolve monitoring obligations to the local level. The attendant cost implications are forcing a greater reliance on partnerships, which may actually be beneficial in that it encourages the consideration of values held by various stakeholders, consistent with the definition of SFM. It also raises concerns, however, about maintaining adequate consistency and linkage to higher-level reporting and planning initiatives.

Another concern about local-level indicators is the degree to which they are consistent with higher-level indicators, such as national systems, and the degree to which they are comprehensive. In many cases, it may be very appropriate to develop indicators specific to particular forest ecosystem types. However, these may not be directly comparable with other indicator systems, presenting problems for the collection of provincial, national and international data. This problem extends to the nature of the databases that are used to collect indicator information and also presents problems of interpretation. In designing any data storage system, allowance must be given for different types of data from different systems.

If different data are collected from different areas, then the likelihood exists that the datasets are incompatible because they contain different combinations of indicators. This creates problems, particularly if SFM is being assessed for over-lapping areas (e.g., for administrative and ecological units). There may also be problems associated with the hierarchical synthesis of data, as the spatial coverage of individual indicators is incomplete. These are all factors that must be taken into account when designing sets of indicators for particular areas.

Challenges

We face the overall challenge of reducing the effort required for different initiatives applied to the same forest area. All forest areas in British Columbia and other jurisdictions are subject to planning and jurisdiction-wide criteria and indicators reporting. Many of these forest areas are also considering, applying for, or maintaining forest certification under one or more systems. Specific challenges to consider while developing local-level information for any of the initiatives are to:

- Keep the end in mind—SFM at the local, provincial, national, and global levels.
- Reduce the effort required in dealing with different initiatives:
    - Improve understanding of overlaps and linkages.
    - Work towards convergence of information requirements.
- Streamline procedures to avoid duplication of effort:
    - Make local efforts under any one initiative consistent with higher-level efforts to facilitate rollups and chaining across scales.
    - Across initiatives, modify initial efforts under one initiative to enable application to other initiatives and scales.
- Improve information management:
    - Examine various functions (collection, storage, archiving, interpretation, analysis, reporting).
    - Select effective tools (data warehouses, geographic information systems, internet access/input).
    - Ensure adaptability (changing business models, platforms, software standards, partners).
    - Ensure credibility by improving underlying science (sampling design, cause & effect models).
- Share responsibilities in an effective and equitable manner:
    - Share information between local and higher levels to reduce costs to both.
    - Encourage collection of better information by other agencies and volunteers (the right information collected in the right manner).
    - Negotiate objectives and targets with the goal of SFM in mind.
    - Negotiate when and how to apply the precautionary principle.
    - Decentralize the appropriate decisions and responsibilities.

Sustainable forest management will require substantial long-term commitments by scientists, information technology specialists and forest managers to ensure that the most effective indicators are used and that investment in monitoring is sufficient to yield the information needed to adequately inform future decisions. There are signs that this is now being realized, as shown by some of the papers presented in this volume. However, considerable work remains to be done if the costs associated with the planning, practice and certification of sustainable forest management are to be kept under control.

References

American Forest and Paper Association (AF&PA). 1999. Sustainable Forestry Initiative Standards, Principles and Objectives. 1999 Edition. Washington, DC.**http://www.afandpa.org/Content/NavigationMenu/Environment_and_Recycling/SFI/Publications1/1999_SFI_Standard.htm**

Alberta Forest Products Association (AFPA). 2000. **http://www.albertaforestproducts.ca/about/welcome.htm** , **http://www.albertaforestproducts.ca/forestcare/ForestCare-brochure.pdf**

Anon. 1998. A framework of regional (sub-national) level criteria and indicators of sustainable forest management in Australia. MIG Secretariat, Forests Division, Department of Primary Industries and Energy, Canberra. 108 p.

Barrow, C.J. 1999. Environmental management: Principles and Practice. Brunner-Routledge, New York. 326 pp.

Boyce, M.S.; Haney A. (eds.). 1997 Ecosystem management: Applications for sustainable forest and wildlife resources. Yale University Press, New Haven. 361 pp.

Canadian Council of Forest Ministers (CCFM). 1995. Defining sustainable forest management—a Canadian approach to criteria and indicators. Ottawa. 22 pp. (http://www.nrcan.gc.ca/cfs/proj/ppiab/ci/indica_e.html) August 2000.

CCFM. 1997. Criteria and indicators of sustainable forest management in Canada: Technical report. Ottawa. 137 pp. (http://www.nrcan.gc.ca/cfs/proj/ppiab/ci/indica_e.html) August 2000.

CCFM. 1998. National forest strategy, 1998-2003. Sustainable forests, a Canadian commitment. Ottawa. 47 pp. (**http://www.nrcan.gc.ca/cfs/nfs/strateg/index.html**) August 2000.

CCFM. 2000. Criteria and indicators of sustainable forest management in Canada: National status 2000. Ottawa. 122 pp.

CCFM. 2003. National Forest Strategy (2003-2008), A sustainable forest: the Canadian commitment. Ottawa.

Center for International Forestry Research (CIFOR). 1999. Criteria and indicators for sustainable forest management. CD-ROM and User Manual. Bogor.

Canadian Standards Association (CSA). 1996. CAN/CSA-Z809-96 Sustainable Forest Management System: Specifications Document. Etobicoke. 12 pp.

D'Eon, R.G.; Johnson, J.; Ferguson, E.A. (ed.) 2000. Ecosystem management in forested landscapes. Directions and implementation. UBC Press, Vancouver. 352 pp.

Dunster, J., Dunster, K. 1996. Dictionary of natural resource management. CAB International, Wallingford.

Forest Authority. 1998. The UK Forestry Standard. The Government's approach to sustainable forestry. Edinburgh, Forestry Commission. 84 pp.

Food and Agriculture Organization of the United Nations (FAO). 1995. Harmonization of criteria and indicators for sustainable forest management. FAO/ITTO Expert Consultation. Rome Italy..

Forest Stewardship Council (FSC). 2000. (http://www.fscoax.org/) August 2000.

Haynes, R.W.; Stevens, J.A.; Barbour, J. 2000. Criteria and indicators for sustainable forest management at the USA national and regional level. In: Forests and Society. The role of forests. Proceedings of the 21st IUFRO World Congress, Kuala Lumpur, Malaysia, 7-12 August 2000. Volume 1. IUFRO, Vienna. pp. 238-246.

Heathcote, I.W. 1998. Integrated watershed management: Principles and practice. John Wiley, New York. 414 pp.

Helms, J.A. (ed.). 1998. The dictionary of forestry. Society of American Foresters, Bethesda, MD. 210 pp.

Holling, C.S. (ed.). 1978. Adaptive environmental assessment and management. John Wiley and Sons, London. 377 pp.

Innes, J.L. 1998. Measuring environmental change. In: Peterson, D.L. and Parker, V.T. (eds.) Ecological scale. New York, Columbia University Press, pp. 459–484.

Innes, J.L. 2003. The incorporation of research into attempts to improve forest policy in British Columbia. Forest Policy and Economics 5: 349–359

Innes, J.L.; Karnosky, D. 2001. Impacts of environmental stress on forest health: the need for more accurate indicators. In: R.J. Raison, A.G. Brown, and D.W. Flinn (eds.) Criteria and indicators for sustainable forest management. CABI Publishing, Wallingford.215-230 pp..

International Organization for Standardization (ISO). 2000. (http://www.iso.ch/) August 2000.

Kimmins, J.P. 1997. Balancing act. Environmental issues in forestry. 2nd edition. UBC Press, Vancouver. 305 pp.

Lammerts van Bueren, E.M.; Blom, E.M. 1997. Hierarchical framework for the formulation of sustainable forest management standards. Principles, criteria, indicators. Wageningen, The Tropenbos Foundation. 96 pp.

Lautenshlager, R.A.; MacLeod, H.; Hollstedt, C.; Balsillie, D. 2000. Examining the Specifics approach to identifying indicators of sustainable natural resource management in Ontario, Saskatchewan and British Columbia. The Forestry Chronicle 76(5): 725–738.

Lee, D.C.; Bradshaw, G.A. 1992. Making monitoring work for managers. [Online], URL: **http://www.icbemp.gov/spatial/lee_monitor/begin.html**

Ljungman, C.L.S.; Martin R.M.; Whiteman A. 1999. Beyond sustainable forest management: Opportunities and challenges for improving forest management in the next millennium. Rome, Food and Agriculture Organization of the United Nations. [Online] URL: **http://www.fao.org/DOCREP/003/X4227E/X4227E00.htm - TopOfPage**.

Madsen, S.; Evans, D.; Hamer, T.; Henson, P.; Miller, S.; Nelson, S.K.; Roby, D.; Stapanian, M. 1999. Marbled murrelet effectiveness monitoring plan for the Northwest Forest Plan. General Technical Report PNW-GTR-439. Portland, OR, US Department of Agriculture Forest Service, Pacific Northwest Research Station. 51 pp.

Maini, J.S. 1993. Sustainable development of forests: A systematic approach to defining criteria, guidelines, and indicators. Paper presented at the Seminar of CSCE Experts on Sustainable Development of Boreal and Temperate Forests, September 27 to October 1, 1993, Montreal, Canada.

Meidinger, E.E. 1997. Organizational and legal challenges for ecosystem management. *In:* Kohm, K.A and Franklin, J.F. (eds.) Creating a forestry for the 21st century: The science of ecosystem management. Island Press, Washington DC. 361-379 pp.

Ministerial Conference on the Protection of Forests in Europe, Helsinki, Finland. 1993. European criteria and most suitable quantitative indicators for sustainable forest management.

Montreal Process. 1995. Criteria and indicators for the conservation and sustainable management of natural forests. Hull, Canadian Forest Service, Natural Resources Canada. 27 pp. (http://www.mpci.org) August 2000.

Mulder, B.S.; Noon, B.R.; Spies, T.A.; Raphael, M.G.; Palmer, C.J.; Olsen, A.R.; Reeves, G.H.; Welsh, H.H. 1999. The strategy and design of the effectiveness monitoring program for the Northwest Forest Plan. General Technical Report PNW-GTR-437, USDA Forest Service, Pacific Northwest Research Station, Portland, OR, 138 pp.

Noss, R.F.; Cooperrider, A.Y. 1994. Saving nature's legacy: Protecting and restoring biodiversity. Island Press, Washington DC. 416 pp.

Pan-European Forest Certification (PEFC). 2000. (http://www.pefc.org/content.htm) August 2000.

Second Ministerial Conference on the Protection of Forests in Europe. 1993. (http://www.mmm.fi/english/forestry/policy/minkonf/second_main.htm)

Simberloff, D. 1999. The role of science in the preservation of forest biodiversity. Forest Ecology and Management 115: 101–111.

Smith, C.T.; Lowe, A.T.; Proe, M.F. 1999. Indicators for sustainable forest management. Papers presented at the IEA Bioenergy Task XII Workshop held in Eddleston, Scotland, 20-25 September, 1997. Forest Ecology and Management 122: 1–5.

UN Conference on Environment and Development, Rio de Jenario, 1992. Annex III, Statement of principles for the Sustainable Management of Forests. [Online] URL: http://www.un.org/documents/ga/conf151/aconf15126-3annex3.htm

U.S. Department of Agriculture, Forest Service. 1996. Status of the interior Columbia basin: summary of scientific findings. Gen. Tech. Rep. PNW-GTR-385. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station; U.S. Department of the Interior, Bureau of Land Management; Portland, OR. 144 pp.

Walters, C.J. 1986. Adaptive management of renewable resources. McGraw-Hill, New York, 374 pp.

Walters, C.J.; Holling, C.S. 1990. Large scale management experiments and learning by doing. Ecology 71: 2060–2068.

World Commission for Forests and Sustainable Development (WCFSD). 1999. Our Forests, Our Future. Cambridge University Press, Cambridge. 77 pp.

Sustainable forest management: The application of criteria and indicator measurements in the United States Forest Service

Albert Abee

National Co-ordinator, Sustainable Development
United States Forest Service

Abstract

Forested land in the United States is jurisdictionally fragmented, managed by many federal, state, industrial and private entities. The U.S. legislative framework, wherein development occurs, has sustainability as a cornerstone. One of the reasons the U.S. journey towards sustainable forest management (SFM) has been problematic is that forest managers lack a common language to facilitate cross-jurisdictional collaboration. Since 1905, the total area of forested land in the U.S. has changed little, yet our collective actions have fallen short of SFM. Planning strategies are changing to foster collaborative stewardship and the harmonization of land-use plans while respecting unique goals, objectives, legislative mandates, and the limitations of the land. The Montreal Process (1995) framework of criteria and indicators is now providing a unifying language of measures to foster collaborative assessment, planning, and decision-making processes at both national and sub-national levels.

Keywords: *Sustainable forest management, Montreal Process, criteria and indicators, United States, Forest Service.*

Introduction

> *Ultimately, the value of Land & Resource Management Plans will be based on, shaped by, and assessed for their contribution to resolving larger community social, economic, and environmental issue.*

This paper discusses the U.S. journey towards ecosystem sustainability, trends in the U.S. forested land base and harvest levels, and shifts in U.S. Forest Service (USFS) planning strategies in response to emerging needs. It provides an application of the Montreal Process criteria and indicator measurement framework to foster collaborative planning processes, improve effectiveness and implementation monitoring, focus scarce resources to highest-priority areas, and improve accountability linking project-level work to the achievement of strategic objectives.

Sustainable ecosystems

The desired outcome of the USFS's activities is captured in the mission statement: "…to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations" (U.S.D.A. 2003). It can be summarized in the phrase, sustainable resource manage-

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

ment. Sustainability should be viewed more as a journey than a fixed destination. In this context, SFM has three components: social, economic, and environment (Montreal Process 1995). These three components are interrelated and must be considered together when making assessments of sustainable resource management.

Sustainable Resource Management is deeply embedded in the legal foundation of the USFS. The 1897 Organic Act's statement of purpose embedded the principle of sustainability. In part, the national forests were established to "…improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States…" (16 USC (United States Code) § 475). Timber was allowed to be sold "For the purpose of preserving the living and growing timber and promoting the younger growth on national forests…" (16 USCA (United States Code Amendment) § 476). While these notions and principles of sustainability were not exhaustive in their meaning, the Organic Act reflects an early understanding that social health and public welfare are affected by and dependent upon natural resources and the management of the landscapes in which they occur.

The U.S. legislative cornerstone mandating and promoting ecosystem sustainability is strong. Other foundational federal environmental laws (i.e., 1969 National Environment Protection Act, 1976 National Forest Management Act, 1960 Sustained Yield Act and Multiple Use Act, 1972 Clean Air Act, 1972 Clean Water Act, 1973 Threatened and Endangered Species Act, etc.), together with an eclectic set of environmental state laws of the 50 states, have further embedded the principles of sustainable resource management. Myriads of local and county ordinances designed to protect the environment concurrent to rural and urban development also contribute to the U.S. institutional capacity to regulate development through threshold standards based on resource sustainability.

Collectively, these laws cover a range of values that characterize the ecosystems people occupy and that provide for human needs. Some legislation is agency specific (such as the National Forest Management Act which applies to the USFS), some unique to states (such as the State of Oregon Forest Practices); and some national in scope but applies differently to ownerships (such as the Threatened and Endangered Species Act). Nevertheless, together, this body of environmental law not only contains minimal thresholds and standards, but also provides for both direction and enablement of activities designed to protect the environment while meeting societal needs. The recent emergence of certification schemes and the adoption of national criteria and indicators of SFM reflect a commitment to continual improvement. (FSC 1998, AF&PA 1999, SAF 1999).

Forested land Is jurisdictionally fragmented

Understanding the context in which US forestry-related work is accomplished is key to informed decision making. No matter how sustainability is defined, it remains a subset of a larger reality that cannot be independently achieved. United States forested ecosystems are managed by a decentralized group of Federal, state, industrial, and private entities (Powell *et al.* 1993), and this is a challenge for SFM.

The 302 million hectares of forest land covers the jurisdictions of the 50 states (Figure 1). States have a long tradition of establishing government entities (agencies, bureaus, offices, departments, commissions, etc.) through which public programs are focused on forest resources. For example, "in 2000, the U.S. states had created 204 governing or advisory bodies, variously labelled as boards, councils, committees, or commissions," (Ellefson and Moulton 2000). States independently developed environmental data standards and protocols, and these are not compatible or comparable.

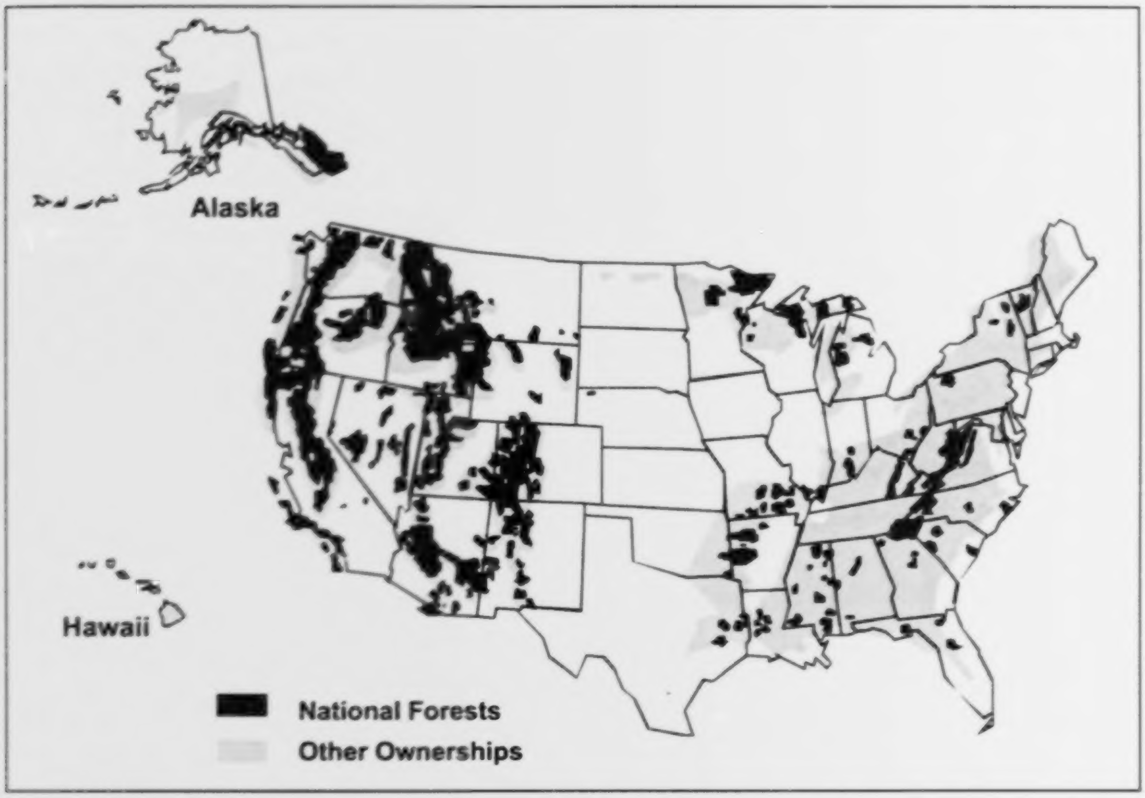


Figure 1. Forest distribution and ownership in the United States.

Land-ownership patterns within states add to the operational complexity of the U.S. forest environment. For example, of the 203 287 000 hectares of timberland, 58% is managed by over six million land owners, 13% by forest industries, 19% by USFS, and 10% by other public agencies (U.S.D.A. 2002). In 1999, nearly 400 public and private entities at the state level were engaged in gathering, managing, or distributing information about forests (National Association of State Foresters 1999). These ownerships have also independently developed forest measurement systems that are largely incompatible with each other.

Adding to the complexity of multiple data languages between ownership patterns is the USFS organization (National Forests, Figure 1). Like many other agencies, the USFS is a hierarchical organization whose management is highly decentralized. The agency has three levels of field management: nine regional offices, 155 National Forest System units (forest, grassland, and prairie offices), and about 550 district offices that manage lands in 42 states, Puerto Rico, and the U.S. Virgin Islands. This has nurtured numerous data collection and storage mechanisms, each satisfying a local need for informed decision-making; however, these are often incompatible and incomparable with neighbouring mechanisms.

Similar effects in the federal, state, and private sectors compound this pattern of complexity. This complexity can lead to confusion for the public, undermine collaborative processes, cause lack of trust, litigation, and often posture managers in a crisis management mode. Managers need to know how their activities affect the sustainability of shared values that cross their respective ownerships. The U.S. Federal

Geographic Data Committee has recognized this problem across all agencies, and efforts are underway to develop national corporate data standards and protocols.

The USFS does have a national grid point inventory system for all U.S. forested land. However, the measurement indices lack social and economic values, as well as indices measuring non-commodity values. Although some corporate data exists at the forest level, data standards and protocols were independently developed, resulting in the development of incomparable or incompatible data. This situation typifies most land management agencies. Added to this operational complexity are the different missions, objectives, and regulatory frameworks of respective forest management organizations.

Related to movement towards ecosystem sustainability, the value of U.S. resource management organizations is not to be found in the management diversity, mission, or even the legal framework, but in the measurable outcomes that reflect their collective actions.

Healthy ecosystems and sustainable economies are goals shared by national, county, state, private, and industrial ownerships

Forest land trends have been relatively stable since 1920 (Figure 2).

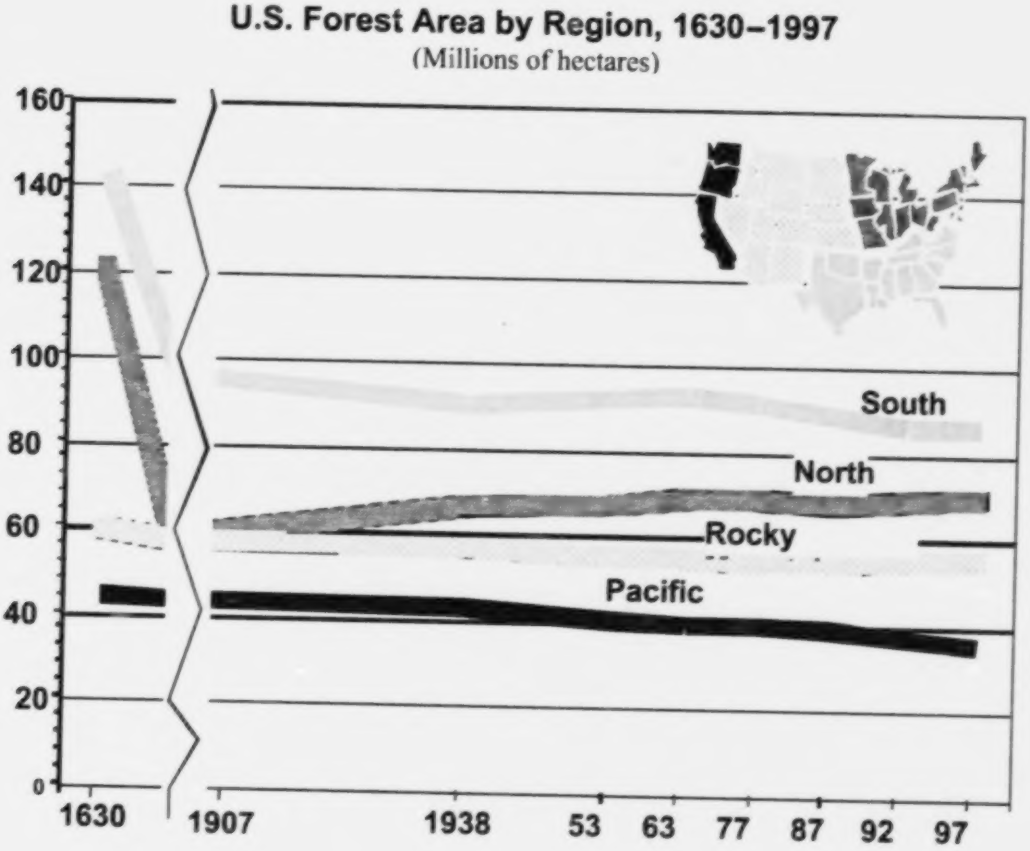


Figure 2. United States forest area by region (1630–1997)

The current U.S. forest land area of 302 million hectares amounts to about 71.5% of the area that was forested at the time of European settlement in 1630 (U.S.D.A. 2002). Since 1630, about 120.5 million hectares have been converted to other uses—mainly to agriculture—primarily in the North and South. After 1910, agricultural clearing subsided and the amount of forest area stabilized. The trend shows that the South and Pacific-West are experiencing modest declines in forest land, as population shifts to those areas, while forest area in the North is increasing.

Figure 3 shows that timber harvest trends have been relatively stable from 1980 to 2001 at about 448 million m^3 (U.S.D.A. 2002). However, harvest from USFS lands has decreased from 66.3 to 22.9 million m^3, while harvest from non-industrial lands has increased from 243.7 to 269.5 million m^3. Shifts in reduced harvest from F.S. lands reflect shifts in societal values promoting recreation, tourism, and old-growth habitat for threatened and endangered species.

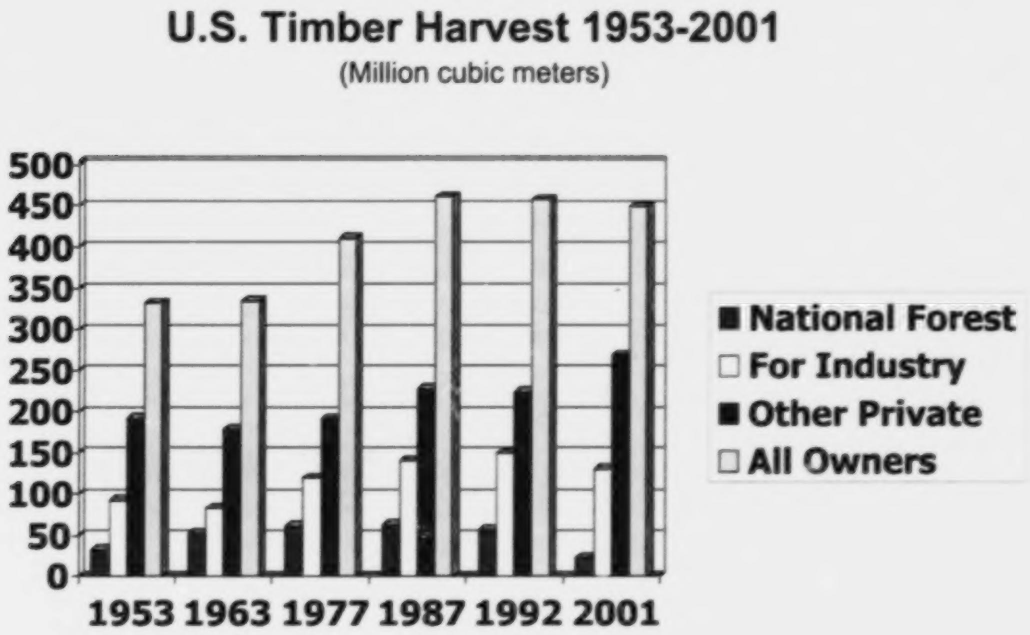


Figure 3. United States timber harvest by ownership (1953–2001).

Many of the problems the U.S. faces in its national forests defy simple administrative solutions along jurisdictional lines. One serious problem is the health of the forest ecosystems. Many national forest lands have a moderate to severe risk of catastrophic fire. Forest health speaks to the importance and need for cross-jurisdictional planning designed to sustain U.S. forested ecosystems and to address common concerns.

Work is often done in isolation or along administrative lines

Although there is progress in managing landscapes more holistically, the collective approach has often fallen short of maintaining the health and sustainability of landscapes (Interagency Ecosystem Management Task Force 1995). Often, neighbouring managers within a landscape do not know how their actions affect landscape sustainability. This confusion undermines collaborative processes, causes lack of trust, litigation, and often postures managers in a crisis management mode. Several things limit collaborative processes:

- Communication: There is a lack of common data standards and collection protocols between neighbouring land managers.
- Consensus: There is little public consensus on how to frame public dialogue regarding SFM.
- Analysis: There is a weakness in integrating environmental, economic and social issues at multiple scales.
- Harmonizing plans: There is difficulty in developing common goals and shared responsibilities with adjacent landowners.
- Funds: There is difficulty focusing scarce funds to highest priority areas.

United States Forest Service planning processes are changing

The National Forest Management Act (NFMA) Planning Rule (PR) that guides FS planning processes was revised in 2000 (Planning Rule 2000). Forest service planning processes stress the importance of sustainability. Planning processes are designed to better incorporate science, research, and interested members of the public into national forest management.

Sustainability is the foundation for National Forest System planning and management. The planning rule establishes requirements for implementation, monitoring, evaluation, amendment, and revision of land and resource management plans. Desired conditions and outcomes associated with them are used as the central reference points for planning. Managers are thus able to establish pathways to desired conditions and orient performance measures, monitoring, and budgeting to those pathways.

The planning rule encourages a spatial approach to planning and analysis that strengthens linkages across ownership and between scales. Collaborative stewardship efforts will prove to be the vehicles of choice for managers to minimize costly litigation, to reconnect and heal impaired landscapes, and to foster community understanding and the development of shared goals (Johnson *et al.* 1999, Yaffee 1999). The planning rule fosters opportunities to move away from a federally focused governmental decision-making structure towards a collaborative design that shares responsibility with others. Managers are expected to provide opportunities for continuous, early, open, and frequent involvement to develop a shared vision and achieve an understanding of proposed actions and their expected outcomes. The desired outcome of collaborative stewardship is healthy ecosystems and sustainable economies. Good collaboration involves people working together more effectively, so that the outcomes of collective stewardship efforts improve and move us toward the national goal of sustainability. The key to success is to work with willing partners, and respect each other's unique roles, responsibilities, land-use objectives, and the limitations of the land. [The planning rule is currently under revision to further clarify, strengthen and simplify existing planning processes (Planning Rule proposed 2002). However, the features identified above will remain.]

Having a planning system that is based on sustainability, uses desired conditions as a reference point, uses broad-scale assessments, encourages collaborative processes, and incorporates science into decision making has great potential to strengthen the ecosystem management approach. However, without a common language of data standards and protocols, cross-jurisdictional communication issues will remain problematic.

Legacy data is a barrier to collaborative processes

As previously noted, most entities that manage forests have data but the data is largely incomparable or incompatible (GAO 1994). Currently the U.S. annually spends hundreds of millions of dollars on data collection without the capability to assess the sustainability of its forested ecosystems, or to effectively and efficiently conduct collaborative processes designed to address common concerns and objectives. The U.S. lacks a unifying measurement framework that crosses ownerships and that integrates social, economic, and ecological indices of sustainability suitable for collaborative processes.

The criteria and indicators of SFM, internationally agreed upon by the 12 countries of the Montreal Process provide a unifying national framework for public dialogue (Criteria and Indicators 1995). They provide the means for measuring SFM "vital signs" across a diverse landscape (Abee 1999). The Montreal Process C&I are as follows:

1. Conservation of biological diversity;
2. Maintenance of productive capacity of ecosystems;
3. Maintenance of ecosystem health and vitality;
4. Conservation and maintenance of soil and water resources;
5. Maintenance of forest contributions to global carbon cycles;
6. Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies;
7. Legal, institutional, and economic framework for forest conservation and sustainable management.

The USFS has adopted the Montreal Process C&I and is leading a national, interagency–NGO roundtable initiative to implement them (SDIT 2003). The roundtable (established in 1998) consists of multiple federal and state agencies that affirmed their commitment to SFM. These partners recognize that SFM on a national scale is beyond the capability of any one agency and must be accomplished through partnerships.

In effect, using the Montreal Process C&I measurement framework will establish a baseline of compatible and comparable data. The C&I are a relatively simple statement of seven key goals (criteria), with associated measurements (indicators) that are designed to promote an understanding of what constitutes sustainable management of temperate and boreal forests. The Montreal Process framework of measures provides a focal point to develop common data standards and prototypes for the indicators. The roundtable partners are working with the Federal Geographic Committee to establish data standards and protocols, and interagency budget submissions to obtain data and to help establish a central data repository that facilitates the sharing of information.

The Montreal Process C&I enjoy broad-based support from a diverse group of national stakeholders. This will help promote communication and help frame public dialog on SFM as well as movement towards consensus. A desired outcome of the roundtable process is to establish the Montreal Process measures as national standards and to embed measures in agency programs.

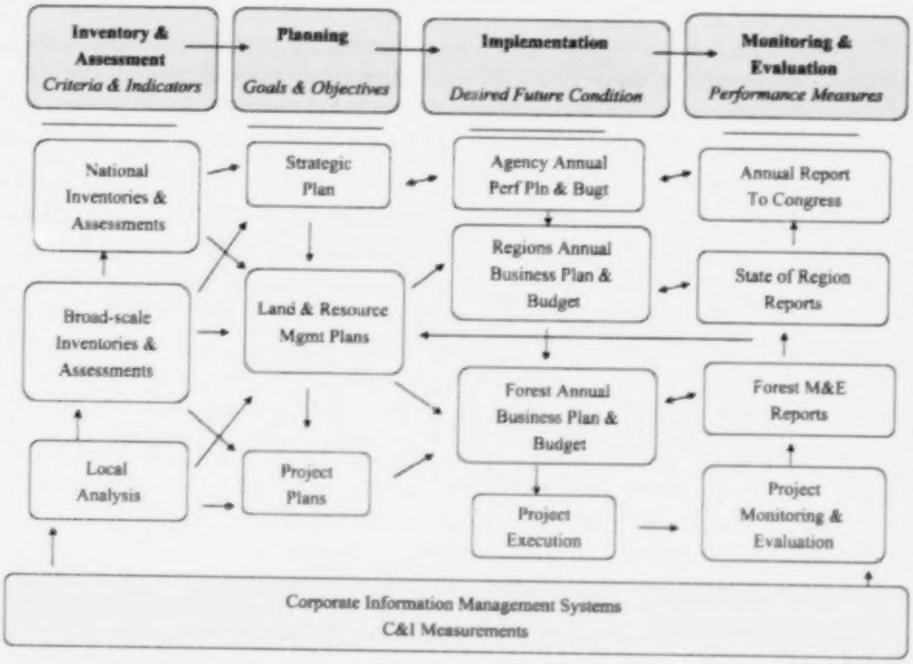
The Montreal Process C&I have strengthened shared analyses through the integration of environmental, economic, and social issues at multiple scales. The Montreal Process C&I enable partners to see how they contribute to SFM, enabling the development of common goals and shared responsibilities with their respective neighbours. The C&I also help to focus scarce funds to highest priority areas, and provide a framework for interagency budget proposals.

At the landscape, regional, or country level, SFM can only be achieved through the collective management results on all lands within an area of interest as measured by criteria and indicators. People need to work together. Any particular management regime's sustainability is best judged by the quality of management versus how it responds to all 67 process indicators. The roundtable partners are seeking to establish a national inventory platform on which respective partners contribute to the gathering of SFM data appropriate to respective roles and responsibilities.

National criteria and indicators help to link interrelated management processes

In addition to providing data and information, the Montreal Process C&I can be used as a unifying framework for strengthening the linkages and relationships between parallel and interrelated processes designed to meet societal needs while also protecting ecosystem sustainability. The USFS is using the C&I to strengthen the relationships between inventory and assessment. planning, budget formulation and execution, and monitoring and reporting. Strengthening the relationship between these processes is an integral component of broadening and deepening sustainability in USFS operational programs. This work contributes to the agency goal to "Improve Organizational Effectiveness, with the related desired 'Outcome': Agency processes and programs are simplified for more effective and efficient management of the nation's forests and rangelands."

For example, the USFS model flow chart (Figure 4) shows key linkages between processes for decision making.



Inventory & Assessment
Criteria & Indicators
Planning
Goals & Objectives
Implementation
Desired Future Condition
Monitoring & Evaluation
Performance Measures
National Inventories & Assessments
Strategic Plan
Agency Annual Perf Pln & Bugt
Annual Report To Congress
Regions Annual Business Plan & Budget
State of Region Reports
Broad-scale Inventories & Assessments
Land & Resource Mgmt Plans
Forest Annual Business Plan & Budget
Forest M&E Reports
Local Analysis
Project Plans
Project Execution
Project Monitoring & Evaluation
Corporate Information Management Systems
C&I Measurements

Figure 4. Management model flow chart for the U.S. Forest Service

The model shows that data is gathered based on criteria and indicators, assessments are performed, goals and objectives are established based on the assessment information, implementation budgets are to move the agency towards desired conditions associated with goals and objectives, and performance measures are developed for monitoring, evaluation, and accountability processes.

The USFS conducts inventories and assessments based on criteria and indicators. Inventories and assessments are done both at the national and sub-national scales. A good national assessment provides the context for landscape planning, and sub-national broad-scale assessments provide the context for project-level work. Sustainability is the desired outcome of USFS activities; therefore key indices of sustainability focus inventory and assessment work designed to address multiple business management practices associated with sustainable resource management. Information in the national assessment uses the seven Montreal Process criteria as an organizing framework, and the indicators to help drive analysis.

After consideration of national assessments, the FS develops a strategic plan that discloses to the public what the USFS proposes to do with appropriated funds received. The strategic plan establishes sustainability goals, outcomes, performance measures, and strategies that apply to National Forest System lands addressed in sub-national land and resource management plans (LRMPs), as well as to the other USFS mission areas. The strategic plan includes specific performance measures to evaluate progress and enable accountability. Sub-national project plans are designed to accomplish the interrelated goals and objectives of both local land and resource management plans and the strategic plan. Project-level plans are designed to carry out specified work associated with accomplishment of annual goals.

The U.S. Congress allocates an annual budget to the USFS which considers the forest service strategic plan. Such annual budget allocations are to enable the USFS to achieve desired conditions. The USFS disaggregates this funding to field offices. For example, the national office in Washington, DC, funds the regions that fund the forests that fund the districts that execute project-level work in local communities.

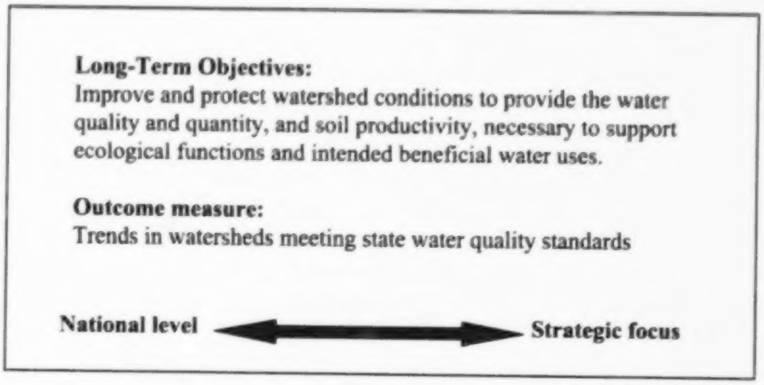
Performance measures identified in annual performance plans are monitored and reported annually, and the measures in the strategic plan are monitored on a periodic basis as described in the plan. Performance measures provide for accountability and information needed for adaptive management. Land and resource management plans are also monitored to evaluate trends in resource conditions and to assess if activities under the plans are having the desired affect. The USFS works to use monitoring indices that are linked between scales and that are included in the C&I framework. Such linkages enable managers to see how their forests contribute to sustainability at higher scales.

Corporate information systems are key to effective monitoring and management at all scales. Inventory and monitoring provide information necessary to evaluate the context and consequences of management options being addressed in the planning process, and must be scientifically and legally defensible. The USFS, and its partners are working to embed the Montreal Process C&I into respective national inventory systems. Not all process indicators are applicable at the local scale. The FS has undertaken research to identify local-level indicators of sustainability (Woodley *et al.* 1998, Wright *et al.* 2002). These local measures can be linked to national indicators as appropriate.

Much more can be said about the management model and the benefits of using the C&I as a tool to strengthen relationships between inter-related planning processes. What is important is that the USFS is not solely top-down or bottom-up in its management. Synergism occurs at all levels and feeds into adaptive management strategies designed to meet emerging needs in carrying out the USFS mission.

Local criteria and indicator measurements should link to higher-scale C&I measures

The aggregated outcome of project-level work reflects national direction. Connecting project-level plans and local activities and performance to strategic goals helps to focus scarce resources to highest priority areas, and enables accountability. Not everything needs to be hard wired, but clear linkages should be established. Figure 5 shows Montreal Process, Criteria 4: Conservation and Maintenance of Soil and Water Resources.

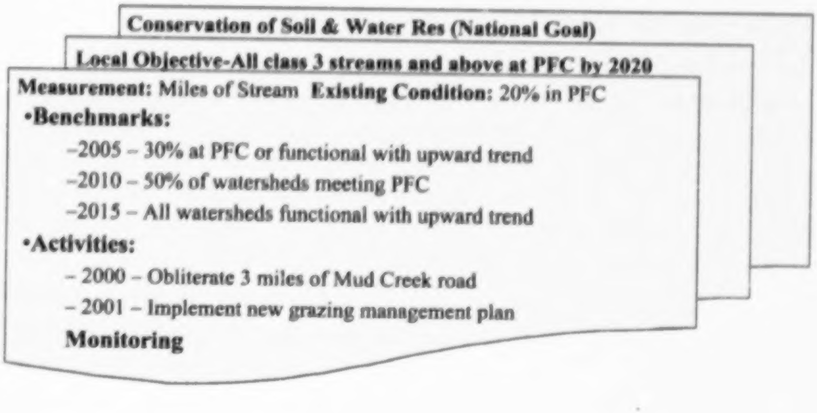


Long-Term Objectives:
Improve and protect watershed conditions to provide the water quality and quantity, and soil productivity, necessary to support ecological functions and intended beneficial water uses.

Outcome measure:
Trends in watersheds meeting state water quality standards

Figure 5. Conservation and Maintenance of Soil and Water Resources (linking project work to strategic objectives)

The national long-term objective is to improve and protect watershed conditions (U.S.D.A 2000b). The national outcome performance measure is the trend in watershed meeting state water-quality standards. In this example, sub-national goals are expressed as achieving proper function condition on all class III streams and above (Figure 6). Local measures include miles of stream that meet proper function condition. Existing conditions, benchmark goals, and related activities are noted and serve managers as reference points from which to gauge progress. Sustainability has been rightly criticized as being a fuzzy idea. The C&I simply identify key attributes that reflect societal values and science information.



Conservation of Soil & Water Res (National Goal)

Local Objective-All class 3 streams and above at PFC by 2020

Measurement: Miles of Stream **Existing Condition:** 20% in PFC

- **Benchmarks:**
  - –2005 – 30% at PFC or functional with upward trend
  - –2010 – 50% of watersheds meeting PFC
  - –2015 – All watersheds functional with upward trend
- **Activities:**
  - – 2000 – Obliterate 3 miles of Mud Creek road
  - – 2001 – Implement new grazing management plan

Monitoring

Figure 6. Outcome File Analysis. PFC = proper function condition.

Monitoring trends often precipitate legislation, policy, and best management practices

The U.S. approach to ecosystem sustainability is characterized by an eclectic set of national and state policies and laws. While these are non-regulatory in nature, they are usually accompanied with a complementary set of land-use guidance and/or a system of best management practices (Sedjo *et al.* 1998). Changes in best management practices, guidance, and the application of certification efforts are activities designed to achieve a desired future condition.

The major private sector organizations currently engaged in creating and implementing sustainable forestry standards in the United States include the American Forest and Paper Association (AF&PA), the American Tree Farm System, the National Woodland Owners Association, Rainforest Alliance's SmartWood program, and Scientific Certification Systems. The AF&PA Sustainable Forestry Initiative details a set of principles and guidelines that are requisite for membership in the association (AF&PA 1993). The initiative principles and guidelines are a mixture of general concepts and tangible measures of company performance in meeting broad objectives. The presence of these programs is in response to consumer demands for responsible land management. While there are differences, the private sector approach to SFM is compatible to the larger effort Montreal Process C&I initiative the sector is involved in.

Challenges to implement the Montreal Process criteria and indicators

Meeting increasing consumer demands from a fixed land and resource base will continue to drive the need for new approaches and solutions to emerging problems that are yet to be defined. It is likely that the success of the USFS and other agencies will largely be decided through ability to conduct open, inclusive, and empowered planning processes in which people (including land-managing neighbours) feel that they have the ability to influence the outcome through involvement. Challenges include:

- developing agreed-upon comparable and compatible data standards and protocols for the indicators;
- getting all partners to commit to using the agreed-upon C&I, and aggressively to embedding them in operational programs;
- establishing a collaborative, national inventory platform from which to gather data, and collect and report on indicators specific to agency missions, and;
- fashioning decision-making structures that are collaborative in design, enable the sharing of responsibility among all levels of government, interest groups, and neighboring land management entities, and respect differing roles and responsibilities, land-use objectives, and the limitations of the land.

Summary

Americans need three things from their forests: a sustainable wood supply, jobs in rural communities, and values associated with healthy ecosystems, such as clean water, recreation, and viable populations of the nation's heritage of plant and animal species. Forest management needs to deliver all three.

One measure of success for protocols such as the Montreal Process C&I framework will be the extent to which they shift the debate about SFM away from two-dimensional arguments about tradeoffs to one that addresses strategic questions about the compatibility of wood production with ecological and socioeconomic goals.

There will always be shifts in the balance of products managed for in the scope and scale of plans, and in the partnerships involved. How do we manage for sustainability in the 21st century? What is different? Sustainable resource management means connecting environmental, social, and economic concerns in dealing with real issues in real places with real people. We need to improve our ability to apply locally what we know, and we must integrate our efforts at different scales (Bosworth 2001).

The desired future condition translates to productive watersheds and ecosystems that meet the full range of human needs. If planning based on short-term quantities of commodities is replaced with planning based on long-term desired future conditions, the three things that Americans need from their national forests—wood, jobs, and healthy forest ecosystems—can be delivered.

Full implementation of the Montreal Process framework of C&I will go far in helping to establish a common language and operational framework in which to bring interested communities together to do collaborative assessment, planning, and decision making designed to meet common needs. The C&I framework is key to mitigating challenges associated with a jurisdictionally fragmented landscape.

Acknowledgements

Figures were designed by: Tom Schmidt, Bill Sexton, Brad Smith, and Steve Solem.

References

Abee, A. 1999. Reducing barriers to assessing sustainability in the U.S. *In:* North American Science Symposium : toward a unified framework for inventorying and monitoring forest ecosystem resources : Fort Collins, CO : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station, 1999. Proceedings RMRS ; P-12. pages 166-171.

American Forest and Paper Association (AF&PA). 1993. "Ecosystem Management: A New Approach to Federal Forest Management and Planning". Washington, DC.

American Forest and Paper Association (AF&PA). 1999. Sustainable forestry initiative 1999 status update. Washington DC. 32 pp.

Bosworth, D. 2001. Forest Service Chief, speech given on The Forest Service's Role in Fostering Sustainability, Society of American Foresters, National Capital Chapter, Washington, DC, May 29, 2001.

Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. 1995. The working group on criteria and indicators: Australia, Canada, Chili, China, Japan, Republic of Korea, Mexico, New Zealand, United States. Canadian Forest Service, Quebec, Canada.

Ellefson, P. V., and R. J. Moulton. 2000. Fragmentation of forest resource agencies and programs: challenges facing state and federal governments in the United States. In *Forests and Society: The Role of Research*,. Sub-Plenary Sessions, vol. 1. XXI IUFRO World Congress 2000. August 7-12, 2000. Kuala Lumpur, Malaysia. pp 589–597.

Forest Stewardship Council (FSC). 1998. Principles and Indicators for sustainable forestry.

General Accounting Office (GAO). 1994. Ecosystem Management: Additional Actions Needed to Adequately Test A Promising Approach. Washington, DC: US GAO/RCED-94111.

Interagency Ecosystem Management Task Force. 1995. The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies, Volume 1. Washington, DC. 55 pp.

Johnson, K.; Abee, A.; Alcock, G.; Behler, D.; Culhane, B.; Holtje, K.; Howlett, D.; Martinez, G.; Picarelli, K. 1999. Management Perspectives on Regional Cooperation. *In:* The Interagency Stewardship Workshop: Common Reference for Ecosystem Management. Sexton, W.T., R.C. Szaro, N. Johnson, and A. Malk, editors. Elsevier Press, Oxford. pp #–#.

Montreal Process Technical Advisory Committee. 1999. Possible Application of Montreal Process National Criteria and Indicators at the Sub-National Level. Montreal Process Working Group, South Carolina, USA. http://www.fs.fed.us/sustained/tac-paper_abee_hendricks.doc.

National Association of State Foresters. 1999. Report of First Approximation Assessment Project. Washington, D.C. http://64.226.137.118/FAAP/default.asp.

Planning Rule. 2000. 36 CFR Parts 217 and 219, National Forest System Land Resource Management Planning; Final Rule, Federal Register: November 9, 2000 (Volume 65, Number 218), Rules and Regulations. pp 67513–67581.

Planning Rule Proposed. 2002. Federal Register: Friday, December 6, 2002 (Vol.67, N0. 235), Proposed Rule. pp 72770–72816, comment period ended April 2003.

Powell, D.; Faulkner, J.L.; Darr, D.R.; Zhu, Z.; MacCleery, D.W. 1993. Forest Resources of the United States. *In*: Table 2, USDA Forest Service General Technical Report RM-234 (Revised). Rocky Mountain Forest and Range Experiment Station. Fort Collis, CO, 80526. 133 pp.

Society of American Foresters (SAF). 1999. Society of American Foresters Task Force on Forest Management Certification Programs: 1999 Report. Bethesda, Maryland. http://www.safnet.org/policy-andpress/fmcp1999.doc

Sedjo, R.A.; Goetzl, A.; Moffat, S.O. 1998. Sustainability of Temperate Forests. Washington DC: Resources for the Future. 102 pp.

Smith, B.W.; Vissage, J.S.; Darr, D.R.; Sheffield, R.M. 1997. Forest Resources of the United States. *In:* USDA Forest Service General Technical Report GTR-NC-219. North Central Research Station, 1992 Folwell Ave, St Paul, MN, 55108. 198 pp.

Sustainable Development Issue Team (SDIT) Action Plan. 2003 update. Integration of Criteria and Indicators Of Sustainable Forest Management. *In:* The U.S.D.A. Forest Service Sustainable Development Issue Team Action Plan. Internal Working document. U.S.D.A., Washington DC.

United States Department of Agriculture Forest Service (U.S.D.A.). 2004. Forest Resources of the United States, 2002, Washington , D.C. 146 pp.

U.S.D.A. 2000b. U.S.D.A. Forest Service Strategic Plan (2000 Revision). Washington, D.C. 84 pp.

U.S.D.A. 2004. Resources Planning Act (RPA) Draft Assessment: Forest Resources of the United States, 2002. GRT-NC-241. North Central Forest Experiment Station, St. Paul, MN. 148 pp.

U.S.D.A. 2003. USDA Forest Service Strategic Plan (2003 Draft Revision)

Woodley, S.; Alward, G.; Gutierrez, L.I.; Hoekstra, T.; Holt, B.; Livingston, L.; Loo, J.; Skibicki, A.; Williams, C.; Wright, P. 1998. North American Test of Criteria and Indicators of Sustainable Forestry. Final Report: Volume 1. USDA Forest Service, Washington DC. 126 pp.

Wright, P.; Colby, J.; Alward, G.; Hoekstra, T.; Tegler, B.; Turner, M. 2002. Monitoring for Forest Management Unit Scale Sustainability: The Local Unit Criteria and Indicators Development (LUCID)

Test. U.S.D.A. Forest Service Inventory & Monitoring Institute. Report No. 5. 2150 Centre Avenue, Suite 300, Fort Collins, CO, 80526. 52 pp.

Yaffee, S.L. 1999. Regional Cooperation: A Strategy for Achieving Ecological Stewardship. Management Perspectives on Regional Cooperation. *In:* The Interagency Stewardship Workshop: Common Reference for Ecosystem Management. Sexton, W.T., R.C. Szaro, N. Johnson, and A. Malk, *editors*. Elsevier Press, Oxford. pp 135–153.

Data collection and auditing of sustainable forest management in Finland

Hanna Nikinmaa

Environmental Specialist,
Indufor Oy, Finland

Abstract

The concept of sustainable forest management (SFM) has broadened the need for data collection in Finland. Comprehensive data collection on forest resources for the National Forest Inventories (NFI) and for forest management planning have been carried out by regional authorities and extension organizations during decades. Specifications for data collection have met the demands of the time, and adjustments have been made according to the changing needs. Traditionally the forest data describes the quantity and quality of timber resources, as well as its production potentials. Other data, especially the indicators that have no direct economic significance, were included in the information databases in the early 1990s. Finland has well-established forestry organizations with long traditions in extension and enforcement work. Finland developed national criteria and indicators for SFM in 1995 based on the proposal for the Pan-European criteria and indicators with data now being collected on the national level. The present challenge in Finland is to streamline the data-collection activities in an efficient way to ensure continuous improvement. Indicators need to describe biodiversity in ecosystems, long-term economic profitability of timber production, non-timber products and other forms of forest use It must also consider the impacts of forest use on employment levels and human well being with consideration given to cultural, recreational and other related aspects.

Key words: *Criteria and indicators (C&I), forest certification, sustainable forest management (SFM), Finland.*

Introduction

Sustainable forest management (SFM) includes the economic, social and environmental quality of forest products. The introduction of this concept to the policy agenda in the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 had a significant impact on development at a policy level as well as on practical forest management. Demands for the integration of social and environmental values with timber production has changed the planning, implementation and monitoring procedures in all forestry organizations.

Finland is a country dominated by small-scale family forestry. There are more than 440 000 private forest holdings with an average size of 36 ha (Figure 1).

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

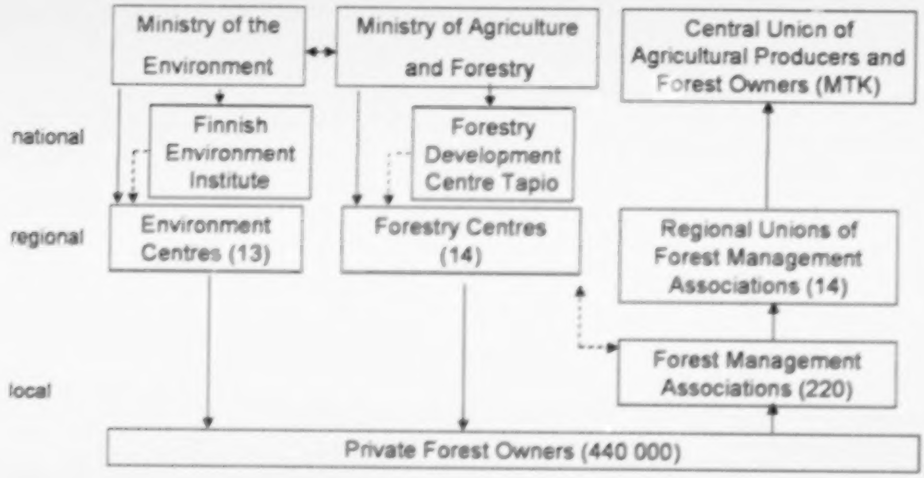

Ministry of the Environment
Ministry of Agriculture and Forestry
Central Union of Agricultural Producers and Forest Owners (MTK)
national
Finnish Environment Institute
Forestry Development Centre Tapio
regional
Environment Centres (13)
Forestry Centres (14)
Regional Unions of Forest Management Associations (14)
local
Forest Management Associations (220)
Private Forest Owners (440 000)

Figure 1. Environmental and forestry administration with respect to private forestry.

These forests provide more than 80% of the annual round wood production (Table 1, below). Forest management planning and monitoring systems have therefore been planned to consider the needs of small forest holdings along with the requirements of larger institutional holdings.

Table 1. A basic overview of the forestry situation in Finland

Forest area[1]	23 million ha	This equates to 76% of land area
Forest ownership	**54% private forests 8% company forests 33% state forests 5% others, communities, etc.**	**The average size of a private forest holding is 36 ha**
Mean Annual Increment	79 million m^3/a	71% in private forests 10% in company forests 13% in state forests 6% in other forests
Annual domestic roundwood trade	**61.5 million m^3/a**	**About 85% of this timber is sourced from private forests**
Protection areas	1.53 million ha of strictly protected forests 2.44 million ha of total protected forest area	This equates to 6.6% of the total forest area This equates to 10.6% of the total forest area

[1] Forest land and scrub land

Sources: Parviainen et al. (2000), Metla (2001)

Finland has well-established forest organizations with long traditions in extension and enforcement work. National Forest Inventories (NFI) have been carried out at 10-year intervals since 1921. However, the data describing biodiversity, forest structure and the social aspects of forestry, especially the indicators that have no economic significance, were not included in the databases until the early 1990s.

Finland has been active in developing criteria and indicators (C&I) for SFM at both the European and national levels. The six Pan-European criteria for SFM form a basis for national forest certification criteria. Voluntary forest certification has contributed to the systematization of data collection and increased co-operation among organizations in private forestry, the forest industry and state forestry.

The present monitoring systems collect data for the criteria defined to describe economic, social and ecological sustainability in forest management. To date, very little follow-up data is available on how descriptive these criteria and indicators are in monitoring the impacts of forestry on ecosystems and social and cultural conditions. There is a need to streamline the data collection in an efficient way in order to ensure continuous improvement in forests and forestry within the concept of sustainable development.

This paper highlights the phases of introducing SFM in practical forest management in Finland and describes the monitoring methods used. The detailed lists of criteria and indicators assessed are presented in annexes. Some discussion is also given on the development needs of C&I for SFM.

SFM as an object for data collection and auditing

Scope

In the forestry sector, auditing is an essential element of supervision and control, and has traditionally been used for verifying that forest owners and operators have complied with legal requirements. Such requirements tend to cover only those aspects of forest management that are regulated. These can include: (a) legal norms for silviculture and harvesting operations, (b) compliance with the approved management plan and (c) implementation of forestry measures supported by the public sector through direct subsidy or soft loans (Nsenkyiere and Simula 2000) and not to set any additional voluntary guidelines or benchmarks at the operational level.

The introduction and definition of SFM in practice is a very complex issue. Practical forest management and monitoring systems need simple guidelines and indicators that describe the level of forest management in economic, environmental and social categories. The existing regional and national sets of criteria and indicators (C&I) for SFM, have been developed from the policy point of view, and their purpose is generally to identify relevant aspects that need to be covered in strategic planning. The purpose of C&I has therefore been to provide a tool for monitoring progress in achieving the goal of SFM (Nsenkyiere and Simula 2000).

SFM represents a new challenge for auditing the impacts of forest management practices for a number of reasons:

1) Many "new" aspects of forest management need to be verified because the C&I for SFM are comprehensive, covering many aspects beyond the legal requirements;

2) Information verifiers may not be readily available and the assessment may have to be more qualitative than quantitative due to the nature of the indicator or lack of baseline information, and;

3) Broader forestry skills are needed in the assessment of non-forestry criteria (Nsenkyiere and Simula 2000).

Indicators

The maintenance and enhancement of biodiversity is a central objective of SFM; a number of countries have adopted it into the forest policy agenda. Data indicating the level of biodiversity in forests should describe the species composition, the structural and spatial distribution of habitats for different key species, and any changes over time. The knowledge required for the determination of indicators designed to measure changes in habitat and species diversity is not always available. The indicators describing the parameters of SFM should be linked to 'real' ecological, as well as economic and social, processes in both ecosystems and society. At the operational scale indicators should be relevant to forest activities and be ecologically integrated. There should also be prescriptive indicators to guide planning, and evaluative indicators that can be used for monitoring and suggesting improvements (Kneeshaw *et al.* 2000). Figure 2 illustrates the connection between desired outcomes (criteria) and the measures taken to achieve these [from the viewpoint of the Finnish Forest Certification Scheme (FFCS)].

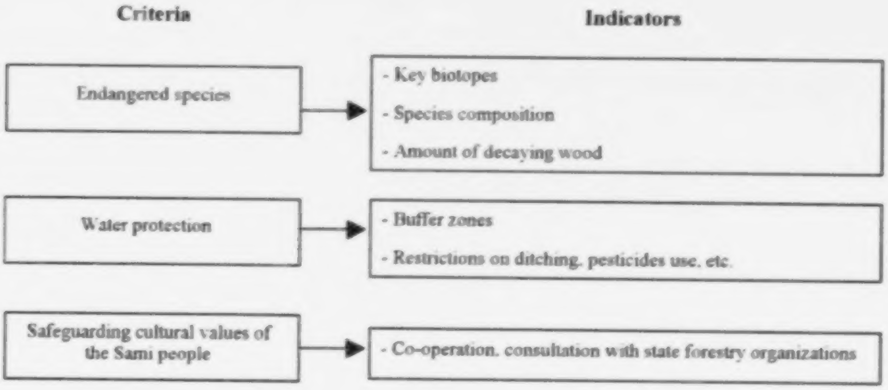

Criteria
Indicators
Endangered species
- Key biotopes
- Species composition
- Amount of decaying wood
Water protection
- Buffer zones
- Restrictions on ditching, pesticides use, etc.
Safeguarding cultural values of the Sami people
- Co-operation, consultation with state forestry organizations

Figure 2. Connection of selected criteria for SFM with the related indicators in Finland.

A number of problems have been identified in the implementation of the national level C&I at the operational scale. These include:

1) Lack of knowledge at an operational scale to evaluate and compare forest management activities to ensure the sustainability of all resources;
2) Many indicators are too broad to be used directly at the local scale of forest management;
3) Provincial regulations are often too prescriptive and rigid to allow for adaptive forest management, and;
4) Forest certification programs, often based largely on public and stakeholder opinion rather than science, may be too locally specific to permit a comparison of operations across a biome (Kneeshaw *et al.* 2000).

Monitoring

The forestry sector in Finland has responded to the new monitoring challenges by increasing non-normative regional- and local-level monitoring. Implementation of voluntary quality or environmental management systems along with forest certification a number of organizations have systemized monitoring and introduced the concept of independent third-party auditing (external audits). The different types of forest management-related auditing functions are identified in Figure 3. All levels of audit functions are needed to ensure a comprehensive yet adjustable and responsive monitoring system that provides data on the level of SFM at the national, regional and FMU levels.

Procedures

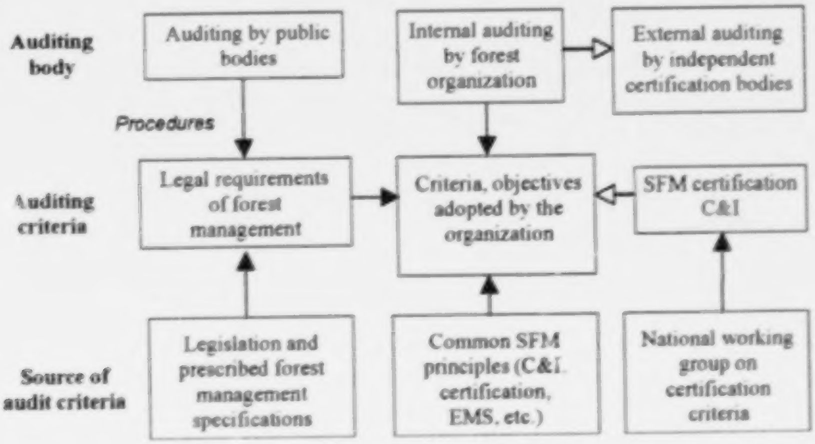

Auditing body
Auditing by public bodies
Internal auditing by forest organization
External auditing by independent certification bodies
Procedures
Auditing criteria
Legal requirements of forest management
Criteria, objectives adopted by the organization
SFM certification C&I
Source of audit criteria
Legislation and prescribed forest management specifications
Common SFM principles (C&I certification, EMS, etc.)
National working group on certification criteria

Figure 3. A framework for auditing sustainable forest management (SFM).

The legal requirements for forestry in Finland set the minimum level for forest management and the subsequent monitoring needs. Voluntary forest certification and environmental management system (EMS) (e.g. ISO 14001) certification require a systematic approach to internal and external audits that complement law enforcement. However, it is important to ensure the separation of the judicial processes and voluntary audits in order to maintain a mutual confidence. In Finland, this is essential to the co-operation between the auditor (internal or external) and the client.

Development of Pan-European criteria and indicators, and operational-level guidelines for SFM

Finland has, along with other European countries, participated in defining the six Pan-European criteria and 23 indicators for SFM (1998), also known as the Helsinki Process or the Pan-European Forest Process (Annex 1). This was an intergovernmental policy process that provided the framework for SFM in Europe. A broad participatory process was then launched to develop national indicators that could be used to describe and evaluate forests in the Finnish situation. In total, 160 indicators were identified in the process. The national-level criteria and indicators were revised in 2000 during an analysis of the state of forestry in Finland (Ministry of Agriculture and Forestry 2000).

The Pan-European C&I were not designed to be applied at an operational level. Therefore the Pan-European operational-level guidelines for SFM (Third Ministerial Conference 1998) were developed to outline the general guidelines for forest management at the operational level. The operational-level guidelines, along with the Pan-European C&I, are now used as a reference when assessing the conformity of national forest certification standards (e.g. FFCS) to the requirements of the Pan-European Forest Certification Framework (PEFC).

Revision of related legislation

The Convention on Biological Diversity, drafted at the UNCED conference in 1992, highlighted the need to review legislation related to forestry and nature conservation in Finland. Preparations for the new Forest Act (1996) and Nature Conservation Act (1996) were made in two parallel processes. The aim was to define the aspects that were to be regulated under each act respectively. Through this procedure, it was possible to avoid the risk of controversial normative regulations (a common result if several laws are applied simultaneously to one practice). The Pan-European C&I were considered during the preparation of the Acts. The new Finnish Forestry Act and Nature Conservation Act were issued in 1997. Regional forestry centres enforce the Forest Act with sampling-based monitoring, along with more traditional enforcement that is based on suspicion of possible violations. Alternatively, the Nature Conservation Act is not practically enforced with sampling based monitoring. The regional environment centre however, studies the suspected violations and does research and surveys in the region (Figure 4).

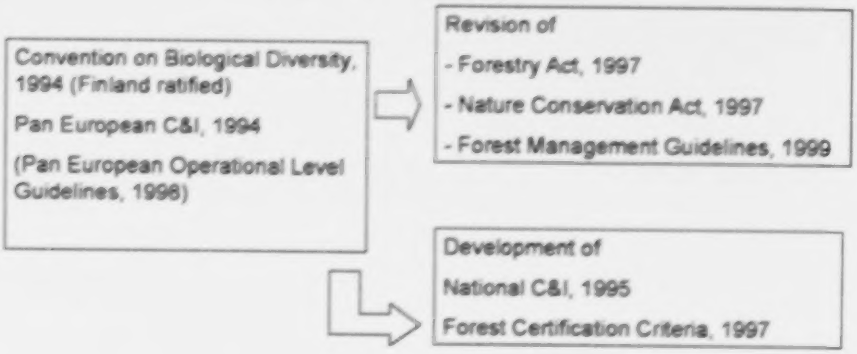

Convention on Biological Diversity, 1994 (Finland ratified)
Pan European C&I, 1994
(Pan European Operational Level Guidelines, 1998)
Revision of
- Forestry Act, 1997
- Nature Conservation Act, 1997
- Forest Management Guidelines, 1999
Development of
National C&I, 1995
Forest Certification Criteria, 1997

Figure 4. Process to Implement SFM at Policy Level

Updating of the National Forest Inventory

The National Forest Inventory (NFI) covers the forest resources in Finland regardless of ownership. The first inventory was conducted between 1921 and 1924. The latest inventory is the ninth (started in 1996), and includes all of the country. The updating of the inventory procedures to meet the requirements of SFM and to introduce the latest developments in survey methodology began during the eighth NFI (1986 to 1994). Today the results of the NFI are based on field measurements, satellite images, and digital geographical information systems (Metla 1999).

Data collection on timber resources has always been comprehensive in Finland. However, more emphasis is now given to the measurement of rare tree species that are significant in the forest ecosystem from a biodiversity point of view. Data on key biotopes and decaying wood has also been added to the NFI database as well as information on retention trees on regeneration sites (Metla 1999). Data on defoliation has been collected beginning in the early 1980s when the damages caused by acid precipitation were the most evident.

The NFI is an objective monitoring system that is based on statistically adequate sampling at the national level to provide regular and valuable information on the condition of forests. The NFI results give good information on the structure of forests and on the tree species composition at the regional (approximately 1.5 million ha) and national levels. The inventory sampling is not adequate to give credible estimates for all indicators at a sub-regional level. The levels of information produced by the various monitoring systems are presented in Annex 2.

Finnish forest certification system

Development of certification criteria and audit guidelines

The Finnish Forest Certification System (FFCS) was developed by a stakeholder group involving representatives from the forest industry, private forest owners' organizations, state forestry, educational and research institutions, forest entrepreneurs, trade unions and environmental and social non-governmental organizations (NGO) (Anon. 1997). The environmental NGOs later stepped out of the process partly because of their commitment to promote only FSC-based certification. The NGOs also deemed the performance requirements of the FFCS insufficient to achieve any considerable improvements in the protection of environmental values in Finnish forests.

The FFCS includes 37 certification criteria that are applied in regional group certification models. The criteria can be classified to improve the ecological, economic and social aspects of forestry as presented in Annex 3. The major objectives in developing the certification criteria were to achieve full compliance with the Pan-European C&I (Pan-European operational-level guidelines were not finalized at that stage) to take advantage of the present control, enforcement, and monitoring systems, and to avoid the establishment of a number of new data collection systems. The information available from the existing monitoring systems is used in the verification of the compliance of forest management with the criteria. Detailed guidelines for data collection are presented in an audit guideline (FFCS 1998). The forest certification criteria are revised periodically, and the latest revised criteria and indicators are posted on the FFCS website (FFCS 2003).

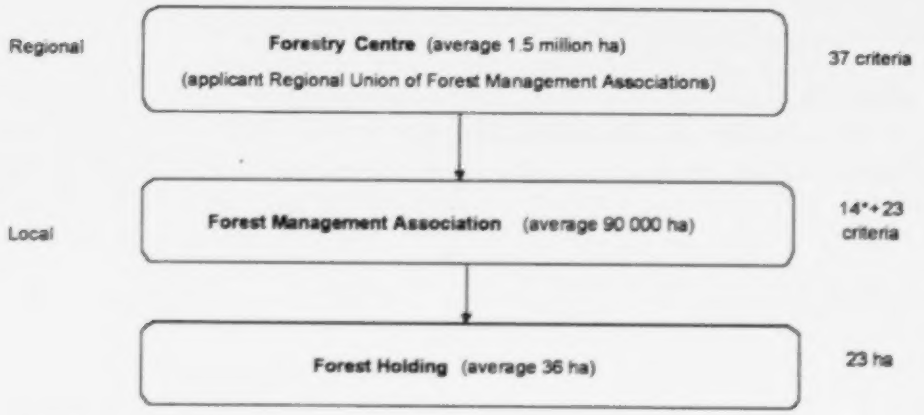
Levels of application

The FFCS is based on group certification, although there is also an option for individual forest owners to submit their own application (Figure 5). The group certification relies on the existing forest-owner and supervisory organizations. The group certification can be applied at two levels:

a) The regional forestry centre level (on average 1.5 million ha), and;

b) The forest management association (FMA) level (on average 90 000 ha).

Until 2003 certification had only been applied at the regional forestry centre level, which is also the unit for regional-level statistics and information (e.g. on forest management planning, silvicultural practices, improvement of forest related infrastructure, and the conservation of biodiversity in timber harvesting). The area of a regional forestry centre is also the smallest unit for which the NFI can provide credible information.


Regional
Forestry Centre (average 1.5 million ha)
(applicant Regional Union of Forest Management Associations)
37 criteria
Local
Forest Management Association (average 90 000 ha)
14*+23 criteria
Forest Holding (average 36 ha)
23 ha

* The first 14 criteria presented in standard SMS 1002-1 (www.ffcs-finland.org) are assessed at a regional level and also in FMA-level certification.

Figure 5. Optional levels of forest certification according to the FFCS.

The group certification model strives to involve as many forest owners as possible in order to achieve better forest management at a large scale rather than on small scattered areas. Forest management unit certification has revealed limitations where small-scale ownership dominates, (the case in Finland). Many social and biodiversity related criteria require implementation at a landscape level rather than on individual holdings or small groups of holdings (Bass and Simula 1999, Kneeshaw et. al. 2000). Forest owners and forestry organizations in Finland wish to take advantage of the certified timber market. Experience has shown that the market advantages are gained only if the source of certified raw material is continuous and fairly abundant to ensure a constant supply of certified products.

To meet the high participation level required in a region, only forestry organizations and large scale forest owners (e.g. industry and state) can apply for regional certification. A large majority of small-scale private forest owners are members of forest management associations (FMA) and they join the regional certification process on the basis of decisions made in the member assembly. Those members who do not wish to participate in the voluntary certification and thus want to act against the decision must give a written notification to the FMA.

Improvements in regional monitoring

General

As the scope of forest management in Finland became broader to include biodiversity management objectives, a need to acquire more detailed data on the impacts of forest harvesting practices became evident. Prior to the early 1990s, the emphasis had been on the regeneration potential of the harvested sites and not on the indicators characteristic of the natural regeneration cycles in boreal forests, such as the amount of decaying wood, tree-species diversity (including non-commercial species) and the natural structure of a forest (one or several canopy layers). No data was collected on the appearance of biologically valuable habitats, the impacts of management practices on the aesthetic values of forest or on water protection.

Limited research-based information was available on the interaction of various species and the different forest resources in Finland. The need to get information on these resources in production forests was recognized as urgent. Initially, the NFI was supposed to include indicators for biodiversity into the forest inventory database, but the five- to 10-year cycle was too slow to wait for the required data. Therefore the supervisory organization, Forestry Development Centre Tapio, launched an annual monitoring programme of Forest Ecosystem Management related to forest harvesting and regeneration. The sampling covers about 2% of the sites harvested during the previous one to two years. The monitoring system gathers data on

- Retention trees left in the area (species, volume, and economic value);
- Management of biologically valuable habitats (quality, habitat area, amount and value of trees in the area);
- Quality of water protection measures (buffer zones), and;
- Quality of landscape management (aesthetic values);

This monitoring system provides a reliable database on the quality of forest harvesting and regeneration at a national level and to a lesser degree at regional levels (i.e., the forestry-centre level). The monitoring results are presented each year and forest management guidelines are adjusted to meet the need for sensitive management practices. The monitoring system focuses on individual sites and does not consider biodiversity management at a landscape level. This is a difficult issue to implement in a country dominated by small-scale private forest ownership.

The regional data collection has also been strengthened by an increase in the level of sampling related to the enforcement of the forest act. This specific need for reliable data is the product of forest certification, in which audit data (e.g. harvesting damages or risk assessment for insect damage) relies on law enforcement. The intensity of sampling considered adequate for enforcement did not provide reliable information for the region from the point of view of forest certification. Therefore, through the implementation of the new Forest Act a survey on biologically valuable key biotopes has been carried out throughout the country to map the key biotopes that are protected by the act.

Data collection in forest certification

The 37 certification criteria of the FFCS are assessed at a regional level with some criteria only requiring a regional level indicator. However, the audits are very much based on Environmental Management System (EMS) audits and focus strongly on the management procedures applied in the various forestry organizations operating in the region. This is done to ensure that the performance requirements are consistently met in all of the organizations.

Annex 3 presents examples of data on indicators that are used to verify the compliance with forest certification criteria in the regional implementation of the FFCS. Forest certification has contributed to improving the impact analysis of forest management and the identification of measures to be taken when the results are not adequate. Regional group certification has also improved co-operation between different groups of forest owners and among different forestry organizations operating in a certified region.

Forest certification criteria in Finland are based on in the Finnish regulatory framework. This is quite demanding following the recent update of the Forest Act and Nature Conservation Act. The need to improve monitoring systems arose from setting sustainable forest management as an objective for all forest management in Finland. The current certification criteria have not imposed any major needs on the monitoring of ecological or economic impacts in Finland's forests. Indicators for forest certification criteria rely on the existing monitoring systems that have traditionally provided regional data, especially on timber resources and silvicultural work. However, the field monitoring of Forest Ecosystem Management during harvesting was launched partly for certification purpose. On the social impacts of forest management, systematic monitoring has been less emphasized in Finland. Considerable effort was needed to get information from the forestry sector on training and on historical sites at a regional level.

Regulations regarding the public availability of site-specific information on private lands (e.g. the appearance of key biotopes, endangered species, timber resources) somewhat restrain the applicability of this data. However, efficient data transfer on the key issues is important for all forestry organizations. A solution ensuring the best possible forest management while meeting the legislative regulations is still being sought. All regional level summary data acquired through internal audits is at least available to all participating organizations

Implementation of environmental management systems in forestry organizations

The adoption and certification of either quality or environmental management systems (QMS or EMS) by a number of forestry organizations has considerably systematized data collection, record keeping and other documentation. Most QMS's applied in Finland comply with standards in the ISO 9000 series and EMS's are compatible with either the ISO 14001 standard or the Eco-Management and Audit Scheme (EMAS) developed by the European Union. The FFCS scheme is not linked with an EMS, unlike some other certification schemes [e.g. Canadian Standard Association Sustainable Forest Management (CSA), Sustainable Forestry Initiative (SFI), or Pan-European Forestry Certification (PEFC)-approved Norwegian Living Forest Standard].

The organizations that participate in the regional forest certification initiatives incorporate the certification requirements into their specific EMS, thereby ensuring compliance to the criteria. Procedures have been taken to streamline the external audits for EMS and regional forest certification so that one audit could assess compliance to both schemes.

Implementation of an EMS in all major industrial forest organizations and in an increasing number of extension organizations has improved knowledge on the quality and impact of operations. Also, the transparency of information has increased because many of the companies now give out data and statistics (e.g. environmental reports on the impacts of their forest operations).

Responsibilities of forest-related data collection

A number of organizations provide data for monitoring the issues associated with forest management in Finland. The main responsibility for data collection lies with the Finnish Forest Research Institute that conducts the National Forest Inventories and compiles statistics on forests and forest management on state and private forest land (Table 2). The data is published annually in the Forest Statistical Yearbook. The Finnish Forest Research Institute also compiles information on national SFM criteria and indicators in collaboration with universities, various agencies and ministries (Veltheim 1998). On the regional and local level, data collection relies more on the activities of each forest owner group. Organizations for private forestry (regional forestry centres and forest management associations) have good knowledge on the forests and forestry in their region. The Forestry Development Centre Tapio provides support for the private forestry sector and conducts an annual assessment of the level of biodiversity conservation on logging sites (Forest Ecosystem Management—monitoring). Large forest industry companies and the national forest and park service (Metsähallitus) (i.e. the agency that administers state forests) monitor the forests under their administration.

Table 2. Examples of Sources of Information for the Verification of SFM

	Level of Application			
Organization	**National** **26 mill. ha**	**Regional** **1 – 4 mill. ha**	**Local** **45 000 – 95 000 ha**	**FMU [1]** **average 35 ha**
Forest Research Institute (NFI [2]), other statistics)	X	X	-	-
Regional Forestry Centres (14)		X		(X)
Forest Management Association			X	X
Forest and Park Service (FPS)[3], Forest Industry			X	(X)
Finnish Environment Centre	X			
Regional Environment Centres (13)		X		(X)
Forestry Development Centre Tapio	X	X		

[1] Forest management unit (private forests 5 – 500 ha, industry and FPS larger units)

[2] National Forest Inventory

[3] FPS represents state forestry

The Finnish Environment Institute and regional environment centres provide information on nature conservation and on the possible adverse impacts of forest management. There is, however a need to improve the co-operation between these environmental agencies and the forestry sector to ensure an adequate exchange of information and knowledge.

In addition to these organizations, verification of SFM in Finland requires information from groups such as the Finnish Game and Fisheries Research Institute on wildlife populations, the National Board of Archives on historical sites and from a number of other regional and national organizations.

Conclusions

Criteria and indicators provide a good general framework for monitoring forest management in a broader context. The indicators should contain prescriptive indicators to guide the planning process, and be evaluative to allow for monitoring and continual improvement (Kneeshaw *et al*. 2000).

When data collection is based on existing monitoring systems (e.g. forest inventories, and other field surveys) credible data can be compiled with fewer economic and human resources. The available information systems have had an impact in defining which levels of certification (FMU, sub-regional, and regional) are the most feasible in Finland. The enforcement of normative regulations and third-party audits for certification should be streamlined as far as possible. However, the fundamental concepts of law enforcement and voluntary auditing should be kept separate.

In countries dominated by small-scale forest-ownership structures, there is great need to increase co-operation among forest organizations (state, industry, and private), especially in the harmonisation of monitoring systems. Regional group certification presents advantages over the traditional certification models in this regard. Auditing has improved the systematic collection and analysis of data. Certification also requires that monitoring results are considered in the planning of further operations. Sound monitoring and auditing of SFM requires more resources than traditional forest monitoring systems.

The effort to achieve SFM in Finland has improved forest management considerably. However we are only at the beginning: we do not know whether the changes in the present management practices are sufficient, and we need to find the means and scale to assess the impacts of the changes. Caution in introducing changes to forest management, especially if they are not done to increase the economic revenue from forests, is understandable. However, the new management models should be based on the best available knowledge, rather than solely on the best compromise achieved between the major stakeholder groups.

References

Anon. 1997. Proposal for a Certification Scheme for the Sustainable Management of Forests in Finland. Working Group on Forest Certification. (www.ffcs-finland.org).

Bass, S.; Simula, M. 1999. Independent Certification/ Verification of Forest Management. Background Paper for the World Bank/WWF Alliance Workshop, Washington, D.C., 9-10 November 1999. 43 pp.

Finnish Forest Certification System (FFCS). 1998 Standard SMS 1002-2, http://www.ffcs-finland.org/eng/esittely/standardit/sms1002_2_e.htm

FFCS. 2003. Revised FFCS Standards (ed. 2003). http://www.ffcs-finland.org/eng/esittely/standardit/standardit_e.htm

Kneeshaw, D.D.; Leduc, A.; Drapeau, P.; Gauthier, S.; Paré, D.; Doucet, R.; Carignan, R.; Bouthillier, L.; Messier, C. 2000. Development of integrated ecological standards of sustainable forest management at an operational scale. The Forestry Chronicle 76: 3. 481-493 pp

Metla. 1999. Valtakunnan metsien 9. inventointi (VMI9). Maastotyön ohjeet 1999. Häme-Uusimaa, Pirkanmaa ja Etelä-Savo. Metsäntutkimuslaitos, Helsingin tutkimuskeskus. Moniste. 145 s.

Metla. 2001. Finnish Statistical Yearbook of Forestry. Finnish Forest Research Institute. Vantaa. Finland. (www.metla.fi)

Messier, C.; Kneeshaw, D. 1999. Thinking and acting differently for sustainable management of the boreal forest. The Forestry Chronicle 75: 6.

Ministry of Agriculture and Forestry. 2000.5a. The State of Forestry in Finland 2000. Criteria and Indicators for Sustainable Forest Management in Finland. (http://www.mmm.fi/english/forestry/publications/MMM%20publication%205a-2000.pdf)

Ministry of Agriculture and Forestry. 1997. The Forest Act (translation from source text: Metsälaki, 1093/1996.). Torniainen, P. (translator). (http://www.mmm.fi/english/forestry/act/actfores.doc)

Nature Conservation Act. 1996. (http://www.finlex.fi/pdf/saadkaan/E9961096.PDF)

Nsenkyiere, E.O.; Simula, M. 2000. Comparative Study on the Auditing System of Sustainable Forest Management for International Tropical Timber Organization. (http://www.itto.or.jp/live/PageDisplayHandler?pageId=203)

Parviainen, J.; Kassioumis, K.; Bückling, W.; Hochbichler, E.; Päivinen, R.; Little, D. 2000. EU/COST E 4: Forest Reserve Research Network Project. Final Report.

Third Ministerial Conference on the Protection of Forests in Europe. 1998. Pan-European Operational Level Guidelines for Sustainable Forest Management (Annex 2 of the Resolution L2). Lisbon. http://www.pefc.org/internet/resources/5_1177_289_file.136.pdf

Third Ministerial Conference on the Protection of Forests in Europe. 1998. Pan-European Forest Process on Criteria and Indicators for Sustainable Forest Management (Annex 1 of the Resolution L2). Lisbon. http://www.pefc.org/internet/html/documentation/4_1311_401/4_1208_169/5_1177_457.htm

Veltheim, Taina. 1998. Helsinki Process and Finland's experiences in developing and using criteria and indicators for sustainable forest management. Paper presented at the Workshop on the Application of Criteria and Indicators to Sustainable Forest Management in Washington D.C., November 1998 (www.mmm.fi)

Annex 1

Finnish criteria and indicators for sustainable forest management

Criterion	Concept area	Indicators
1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles	Forest resources	2 quantitative 10 descriptive
	Carbon balance	2 quantitative 4 descriptive
2. Maintenance of forest ecosystem health and vitality		6 quantitative 4 descriptive
3. Maintenance and encouragement of the productive functions of forests (wood and non-wood)	Wood production	3 quantitative 8 descriptive
	Non-wood forest production	2 quantitative 10 descriptive
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystem	General conditions	17 descriptive
	Biological diversity in production forests	18 quantitative
	Protected forests	7 quantitative 4 descriptive
	Threatened species	1 quantitative 6 descriptive
5. Maintenance and appropriate enhancement of protective functions in forest management		4 quantitative 7 descriptive
6. Maintenance of other socio-economic and cultural functions and conditions	Significance of the forest sector	6 quantitative 10 descriptive
	Research and education	7 quantitative 4 descriptive
	Recreational services	4 quantitative 6 descriptive
	Public participation	7 descriptive
	Cultural values	2 quantitative 6 descriptive

Source: Veltheim, T. 1998

Annex 2

Levels of Monitoring and Data Collection in Forestry		
Monitoring system	**Data collected**	**Level(s) of application**
Forest Research Institute: National Forest Inventory (NFI)	• data on site and soil classification and site productivity, soil types • canopy coverage • topography of the site • information on possible drainage • type and quality of key biotopes • quality of forest management on key biotopes • area and biological value of a key biotope • data on trees promoting biodiversity • appearance of lichens • vertical structure of the forest (canopy layers) • regeneration method, development and age class of the stand • tree species ratios, tree density • mean diameter, height and volume of the stand • possible damages in the stand • productive quality of the stand (economic) • forest management practices • on special sampling plots more detailed data on trees and vegetation is collected • amount and quality of decaying wood	- Credible on national and regional levels. - Sampling is not adequate on a sub-regional level. - Gives statistical data on the structure and quality of forests.

Annex 2 Cont.

Levels of Monitoring and Data Collection in Forestry		
Monitoring system	**Data collected**	**Level(s) of application**
Regional Forestry Centres	• Sampling related to law enforcement, e.g. on the quality of regeneration and harvesting practices, maintenance of key biotopes, quality of road construction and ditch-cleaning practices, measures to prevent bark beetle damage.	- Regional level, sampling density is not adequate for a county or local-level interpretation.
	• Survey on biologically valuable key biotopes as defined in the Forest Act.	- Database will be applicable on regional and local levels.
	• Annual monitoring of the impacts of harvesting and regeneration of the biodiversity of forests: collects data on retention trees, decaying timber, water protection on specific management compartment	- At regional and national levels, sampling is not adequate for local-level interpretation.
	• Regional- and forest management unit level (FMU) forest management planning and identification of regional level development needs based on the available (NFI and forest management plans) data and experience. A very detailed database is collected in the holding-level forest management planning (cf. data collected in NFI)	- Regional and local levels
	• Forestry centres are informed about all planned harvesting operations in the region: they also approve road construction and ditching plans for most of the private forests, thus acquiring data on the amount of forest management operations in the region. The forestry centres compile statistics on the area of silvicultural works and on the number of people employed in forestry.	- Applicable at regional and mostly also at local levels
	• Forestry centres give training to staff , forestry workers, and to forest owners. Yearly statistics on the amount of training courses including also training carried out by other organizations are compiled.	

Annex 2 Cont.

Levels of Monitoring and Data Collection in Forestry		
Monitoring system	**Data collected**	**Level(s) of application**
Forest Management Associations	• The associations support private forest owners in all tasks related to forest management and timber selling. Only road construction and drainage are mostly supervised by the regional forestry centres. • The association compiles data on silvicultural operations, labour need, and training activities on the local (county) level. They also follow closely the timber sales and price development in the area. The local-level statistics are further transferred to the forestry centres for compilation at a regional level.	- Local (county)-level data
Forest industry, state forestry and other large scale forest owners	• Practically all large-scale forest owners have detailed forest management plans for the forest estates. They have own professional staff to run the forestry operations. • Landscape management is considered especially in state forestry. • Forest certification has increased data transfer from these forest owners to their regional forestry centres on key biotopes, water protection measures, silvicultural operations, road construction and drainage, and supplementary training Forestry centres compile the data for regional-level internal audits.	- Local-level data

Annex 3

Finnish Forest Certification Scheme criteria for sustainable forest management

Examples of data needed for forest certification and the source of the data

Certification Criteria	Indicator(s)	Implementation level [1]	Source of data
Criteria related to environmental sustainability			
1. Compilation of SFM target program	- program	regional	- participatory[2] process
2. Increase in prescribed burning	- burned area	FMA	- FMA, forest owners - forestry centre, forest industry, state forestry
3. Preservation of key biotopes	- annual field monitoring	regional	- forestry centre, forest industry, state forestry - (Monitoring of forest ecosystem management)
4. Minimum proportion of aged forests	- data on stand age	regional	- NFI
5. Monitoring of forest ecosystem management	- monitoring system	regional	- forestry centre, forest industry, state forestry
6. Marking of special habitats in forest management plans	- planning guidelines, plans	FMA, FMU level	- forestry centre, FMA, other planning organizations
7. Preservation value of protected areas is not endangered	- information from env. authorities	FMA	- environment centre (authority)
8. Known habitats of endangered species are safeguarded	- information from env. authorities	FMA	- environment centre (authority)
9. Retention trees are left on regeneration areas	- number of trees	regional, FMA, FMU level	- forestry centre, forest industry, state forestry (Monitoring of forest ecosystem management)
10. Domestic tree species are used in forestry	- seedling procurement documents	FMA, FMU level	- FMA, industry, state forestry

Annex 3 Cont.

Finnish Forest Certification Scheme criteria for sustainable forest management

Examples of data needed for forest certification and the source of the data

Certification Criteria	Indicator(s)	Implementation level [1]	Source of data
11. Environmental impact assessment of forest road plans	- road construction plans	FMA, level	- forestry centre, industry, state forestry
12. No first-time drainage is carried out	- drainage plans	regional, FMA	- forestry centre, industry, state forestry
13. Water protection plan in drainage	- drainage plans	regional, FMA	- forestry centre, industry, state forestry
14. Buffer zones for waterways and small bodies of water	- quality of buffer zones	regional	- forestry centre, forest industry, state forestry (Monitoring of forest ecosystem management)
15. Target criteria for soil scarification	- quality of soil scarification	regional	- forestry centre, forest industry, state forestry (Monitoring of forest ecosystem management)
16. Restrictions on the use of pesticides	- organization specific data on the use, guidelines	FMA, organizational level	- FMA, forestry centre, industry, state forestry, others
17. Restrictions on the use of fertilisers	- organization specific data on the use, guidelines	FMA, organizational level	- FMA, forestry centre, industry, state forestry, others
18. Preservation of valuable landscape complexes	- planning guidelines, information of env. authority	regional, organizational level	- FMA, forestry centre, industry, state forestry, others, environment centre (authority)
Criteria related to economic sustainability			
1. Compilation of SFM target program	- program	regional	- participatory 2) process
2. Silvicultural recommendations	- regional and org. level recommendations	organizational level	- forestry centre, industry, state forestry
3. Forest management plan coverage	- aerial coverage of planning	regional	- forestry centre, industry, state forestry

Annex 3 Cont.

Finnish Forest Certification Scheme criteria for sustainable forest management

Examples of data needed for forest certification and the source of the data

Certification Criteria	Indicator(s)	Implementation level [1]	Source of data
4. Implementation of urgent tending of seedling stands	- area needing tending, tending areas	regional	- NFI, forestry centre - (FMA, industry, state forestry)
5. Promotion of first thinning	- promotion plan	regional	- UFMA 3), forestry centre, industry, state forestry
6. Increase in biological control of root rot and spongy sap root	- control area	regional, organizational level	- forestry centre 4), industry, state forestry
7. Total drain of the growing stock is less than increment	- data on increment and removal	regional	- NFI, forest research institute
8. Forest regeneration is ensured (proportion of unforested stands is less than 5%)	- data on development classification of forests	regional	- NFI
9. Monitoring of forest harvesting damage and other forms of forest damages	- enforcement of Forest Act (harvesting damages), other statistics	regional	- forestry centre - (forest industry, state forestry)
10. Master plan for forest road network	- plan	regional	- forestry centre and other forest organizations (partly participatory process)
11. Target criteria for ditch cleaning and supplementary ditching	- data on law enforcement, guidelines	regional, organizational specific	- forestry centre, forest industry, state forestry
12. Avoidance of forest harvesting damage	- law enforcement	regional	- forestry centre

Annex 3 Cont.

Finnish Forest Certification Scheme criteria for sustainable forest management

Examples of data needed for forest certification and the source of the data

Certification Criteria	Indicator(s)	Implementation level [1]	Source of data
Criteria related to social sustainability			
1. Compilation of SFM target program	- program	regional	- participatory(2) process
2. Supplementary training of staff (20% of staff is trained annually)	- proportion of people trained, training programs	regional, organizational level	- forestry centre compiles data from a number of regional organizations
3. Adequate instructions to employees	- guidelines	organizational level	- regional organizations
4. Training and extension of forest owners (participation in training covers 10% forest owners)	- proportion of people trained, training programs	regional, organizational level	- forestry centre compiles data from a number of regional organizations
5. Adherence to statutory obligations of employers (legal duties, taxes, employment legislation and collective agreements in force)	- guidelines for contractor agreements, verification of related documents	organizational level	- Each participating organization ensures full compliance to the criterion in the internal audit.
6. Everyman's rights are safeguarded (free access, related rights and obligations	- the right have the basis in a common law	regional	- regional environment centres enforces the law
7. Preservation of ancient monuments	- enforcement of the laws on Ancient Monuments and Historic Sites, data on the sites, management guidelines	regional, FMU level	- National Board of Archives - regional museums

Annex 3 Cont.

Finnish Forest Certification Scheme criteria for sustainable forest management Examples of data needed for forest certification and the source of the data			
Certification Criteria	**Indicator(s)**	**Implementation level** [1]	**Source of data**
8. Safeguarding of Sami people's traditional means of livelihood and culture (on state lands)	- co-operation and participatory processes in forest management planning on the important areas in state forests	regional	- state forestry and Sami organizations (First Nations)
9. Integration of reindeer husbandry and forestry (traditional livelihood for Sami people)	- co-operation and participatory processes in forest management planning on the important areas in state forests	regional	- state forestry and Sami organizations (First Nations)

[1] In the present certifications all indicators are assessed at the regional level, this column indicates whether the data available can be applied also on a local (county) level without losing its credibility.

[2] A participatory process in the region led by the regional Forestry Centre.

[3] UFMA is the regional Union of Forest Management Associations.

[4] Subsidies are handed to practice the control in the private forests, which is the reason regional forestry centres that administer the subsidies have the data on the control areas for private forests.

FMA Forest Management Association
FMU Forest management unit
NFI National Forest Inventory

Criteria and indicators for the sustainability of non-timber forest products and services at the local level: a case study at the Haliburton Forest and Wild Life Reserve Ltd., Ontario

Thorsten Mrosek

International Institute for Forest Ecosystem Management and Timber Utilization North-Rhine/Westphalia,
University of Münster
Robert-Koch-Str. 26, 48149 Münster, Germany

David Balsillie

Faculty of Forestry, University of Toronto
Earth Sciences Centre, 33 Willcocks Street, Toronto, Ontario, Canada M5S 3B3

Abstract

The consideration and provision of non-timber forest products and services (NTFPs) are important elements of sustainable forest management (SFM) and they are addressed within the concepts of forest management planning, criteria and indicators (C&I) for SFM, and certification. There is a need for further prioritization and standardization of data collection methods for measuring and monitoring NTFPs among these concepts. Suitable local-level case studies for evaluating the sustainability of NTFPs are still lacking. This study took place within a research project on the development and testing of a C&I system for SFM at the local level. The case study took place at the Haliburton Forest & Wild Life Reserve Ltd., Ontario. The set of C&I was developed mostly based on the outcomes of the Center for International Forestry Research North American Test of C&I for Sustainable Forestry, and was completely implemented and field tested. Within the testing of the C&I system, a recreational use analysis, an economic performance audit, and a forest values survey were conducted in order to measure the indicators related to NTFPs. Quantitative and qualitative data show that the forest is managed sustainably for a wide range of NTFPs. The presented C&I system for SFM at the local level is suitable for the evaluation of the sustainability of NTFPs.

Keywords: *Non-timber forest products (NTFPs), forest management, criteria and indicators, local level, case study, Ontario.*

Introduction

During the last decade, the concept of sustainable forest management (SFM) has become increasingly important from local to international levels (Wiersum 1995, Ferguson 1996, Kohm and Franklin 1997, Von Gadow *et al.* 2000, Davies *et al.* 2001). Traditional forest policy and management approaches for

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

sustainable forestry have been supplemented by new evaluation and auditing concepts such as criteria and indicators (C&I) for SFM (Third Ministerial Conference on the Protection of Forests in Europe Liaison Unit in Lisbon 1998, Wijewardana *et al.* 1998, Montreal Process Liaison Office–Canadian Forest Service 2000) and certification (Forest Stewardship Council 2000, Pan-European Forest Certification Council 2000).

The provision of a wide range of non-timber forest products and services (NTFPs) on a sustainable basis is an important element of SFM (Drengson and Taylor 1997) and is required in the processes of forest management planning, C&I for SFM, and certification. Although all three approaches are different in purpose and method, they have similar data requirements for the evaluation of NTFPs. For forest management purposes, NTFPs can be conceptualized as products (e.g. hunting, trapping, and collection of fruits or mushrooms) and services (e.g. recreational opportunities and environmental services such as clean air and clear water). Furthermore, NTFPs include market (e.g. user fee based recreational activities) and non-market values (e.g. aesthetic, cultural or spiritual) (Drengson and Taylor 1997, Mrosek and Camphausen 2000). A variety of quantitative and qualitative measurement methods for the evaluation of NTFPs have increasingly become available (Bidinosti 1998, Beckley *et al.* 1999), but the most suitable methodologies from a practical forest management perspective have yet to be identified. Data availability for reporting on the sustainability of NTFPs is sufficient for market values, but insufficient for non-market non-timber values, and there is still a lack of suitable case studies.

From 1998 to 2002, the Faculty of Forestry, University of Toronto, conducted research on the development and testing of a C&I system for SFM at the local level. This research project took place as a case study at the Haliburton Forest & Wild Life Reserve Ltd., Ontario, which is privately owned and employs an integrated, multiple forest use and nature-oriented management system. The study was based on the hypothetical suitability of C&I for defining, measuring, assessing and monitoring sustainability at the local level. The objectives of the project were to develop a C&I system that consists of an optimal and minimum set of C&I, which also has generic applicability for the SFM of temperate forests internationally, and can be utilized as an adaptive management system.

This paper introduces the C&I system for the evaluation of NTFPs at the local level, and presents Haliburton Forest & Wild Life Reserve Ltd. as a suitable case study for the testing of the C&I. Within the testing of the C&I system, a recreational use analysis, an economic performance audit and a forest values survey were conducted in order to measure the indicators related to NTFPs.

Method

Study area

The research project took place as a case study at the Haliburton Forest & Wildlife Reserve Ltd. (Haliburton Forest) in Ontario, Canada. This forest is privately owned and covers 25,000 hectares, of which 20,000 hectares are forested. It is located 270 km northeast of the city of Toronto. The Haliburton Forest lies in the Great Lakes–St. Lawrence Forest Region, and is characterized by tolerant hardwood forest types dominated by sugar maple (*Acer saccharum* Marsh.). The forest consists of 24 tree species, includes approximately 50 lakes and 250 wetlands, and is characterized by an associated diversity of wildlife (Mrosek, Heaven and Wiskow, 1999). Although the forest was heavily harvested historically in the form of high-grading, its overall naturalness and natural diversity are still high, and a forest conservation concept, including a protected areas network, has been implemented (Mrosek 1998, 2001). A selection cut silviculture system is currently being applied.

The selected forest is highly suitable as a case study because of its size, land-ownership type, and natural diversity. It is suitable for the testing of NTFPs sustainability indicators, in particular, because of its advanced integrated, multiple use and nature-oriented forest management concept. This sustainable forest management concept aims at integrating multiple forms of forest use such as timber harvesting, manufacturing of log cabins, hunting, camping, canoeing, snowmobiling and outdoor education with aspects of forest ecology and conservation (Schleifenbaum 2000). Figure 1 shows the diversity of the multi-purpose operation, with timber harvesting contributing only 21% of the overall income.

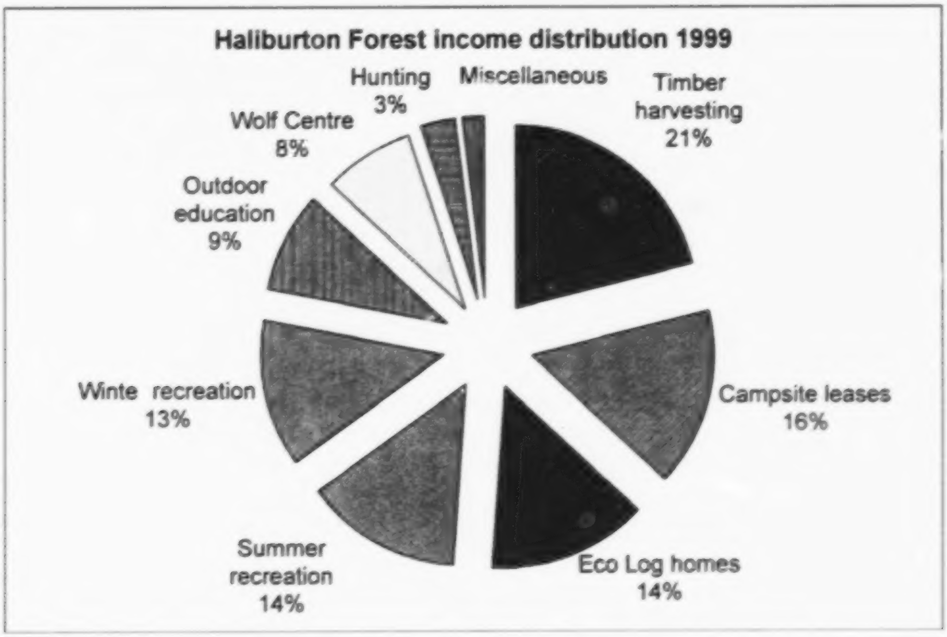


Figure 1. Haliburton Forest income distribution 1999 showing the importance of NTFPs relative to forest products (Schleifenbaum 2000).

In February 1998, the Haliburton Forest was the first forest management unit (FMU) to be certified by the Forest Stewardship Council (FSC) in Canada (SmartWood 1998).

Methodology

The methodology that was applied for the development and testing of the C&I system for SFM at the local level included:

- the review and synthesis of principles, C&I, verifiers, and norms for SFM at various levels;
- the selection and development of an optimal and minimum generic set of C&I for SFM at the local level, mostly based on existing sets;
- the identification of verifiers and norms for the case study area;
- the implementation and testing of the generic C&I set as a case study;

- the development of a database of indicator measurements and the application of a geographic information system;
- the assessment of the state of the forest and forest management practices;
- the application of adaptive management procedures, and;
- the evaluation of the suitability of the C&I system for the determination of sustainability.

The generic C&I set is mostly based on the outcome of the Center for International Forestry Research (CIFOR) North American Test of C&I for Sustainable Forestry (Woodley *et al.* 1998a,b) and the CIFOR Generic Template (C&I Tool No. 2) (CIFOR 1999), but both sets were modified and extended. The complete methodology that was applied for the development of the C&I system and set is described in detail in other papers (Mrosek and Balsillie 2001a, Mrosek 2002).

Methods that were applied for the field testing of the five indicators related to NTFPs (described in more detail in Section 3.3) included:

- a recreational use analysis applying descriptive and direct market price methods;
- an economic performance audit, applying a direct assessment method (Slingerland 2000), and;
- a forest values survey, applying a questionnaire method (Mrosek and Camphausen 2000).

The recreational use study included a descriptive analysis of the recreational opportunities at the Haliburton Forest and its recreational use and wildlife management system. This analysis was based on existing management planning and inventory data, as well as on the establishment of a geographic information system (ArcInfo and ArcView). Because the Haliburton Forest offers all recreational activities on a user-fee basis, a direct-market price method was applied in order to analyze the economic importance of each non-timber market value (Slingerland 2000).

The economic performance audit was based on a direct assessment method for analyzing the complete income, cost and rent structure of the Haliburton Forest covering all timber and non-timber market products and services provided by the company (Slingerland 2000).

The forest values survey was conducted by questionnaire. From March to August, 2000, a total of 516 forest visitors were interviewed concerning the importance of 17 forest timber and non-timber products, services and values. The participants were also asked to rank four forest management options covering timber production, recreational use management, forest conservation, and an integrated resource management approach (Mrosek and Camphausen 2000).

Additional field-testing methods that were applied relating to the remaining indicators are described in other papers (Mrosek and Balsillie 2001a, Mrosek 2002).

Results

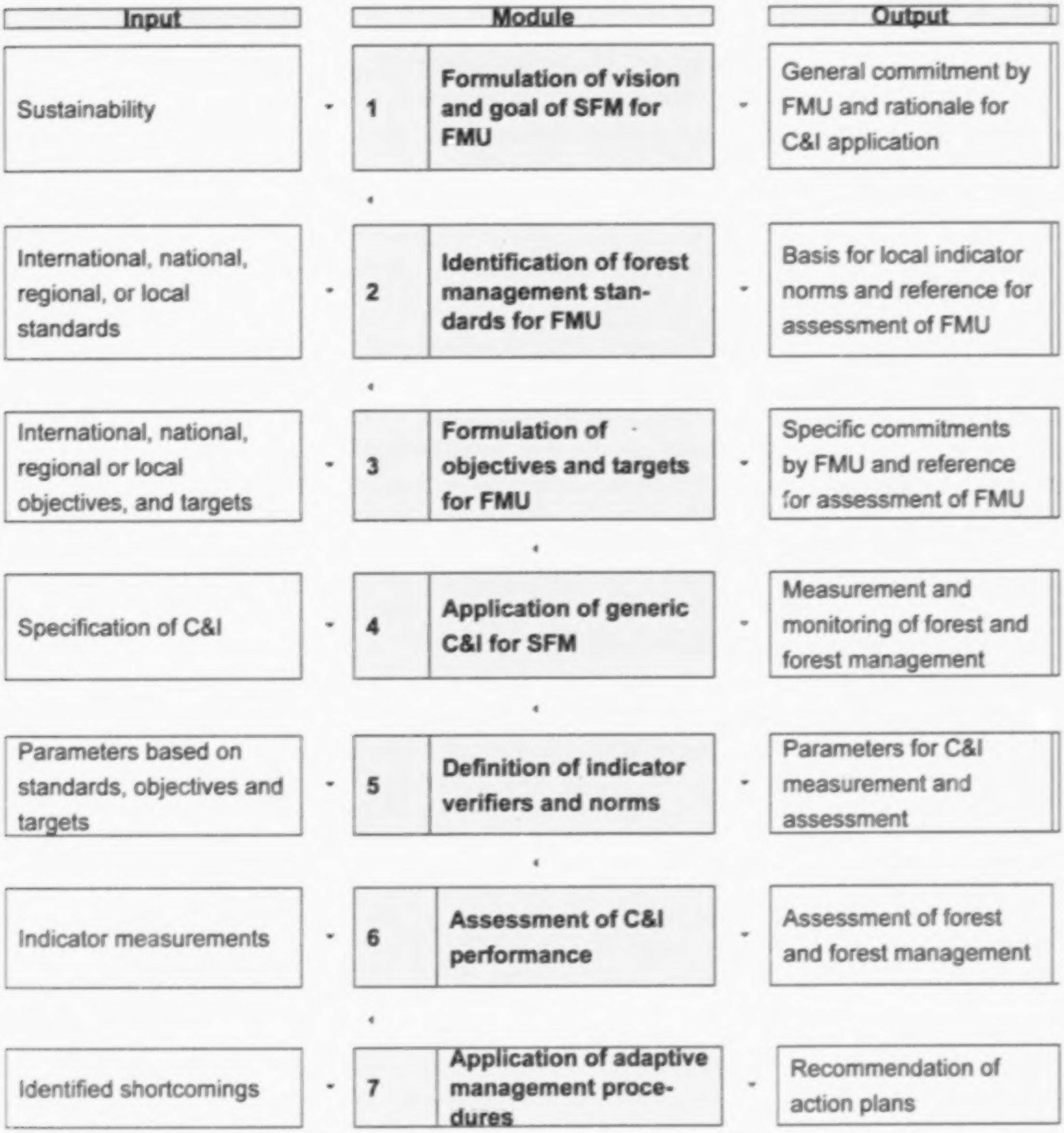
Criteria and indicators system

The C&I system consists of a sequence of generic modules that can be applied internationally in temperate forests by specifying and addressing local conditions. These modules are:

- the formulation of objectives for the FMU;
- the identification of local forest management standards for defining indicator norms;

- the application of the generic set of C&I;
- the assessment of C&I performance in comparison to objectives and norms, and;
- the application of adaptive management procedures (Mrosek and Balsillie 2001a, Mrosek 2002).

The entire C&I system for SFM at the local level is shown in Figure 2.



Input		Module	Output
Sustainability	1	**Formulation of vision and goal of SFM for FMU**	General commitment by FMU and rationale for C&I application
International, national, regional, or local standards	2	**Identification of forest management standards for FMU**	Basis for local indicator norms and reference for assessment of FMU
International, national, regional or local objectives, and targets	3	**Formulation of objectives and targets for FMU**	Specific commitments by FMU and reference for assessment of FMU
Specification of C&I	4	**Application of generic C&I for SFM**	Measurement and monitoring of forest and forest management
Parameters based on standards, objectives and targets	5	**Definition of indicator verifiers and norms**	Parameters for C&I measurement and assessment
Indicator measurements	6	**Assessment of C&I performance**	Assessment of forest and forest management
Identified shortcomings	7	**Application of adaptive management procedures**	Recommendation of action plans

Figure 2. C&I system for SFM at the local level in temperate forests (modified and extended from Mrosek and Balsillie 2001a, Mrosek 2002).

Criteria and indicators set

The generic C&I set for SFM at the local level in temperate forests consists of four principles, 16 criteria, and 58 indicators, and has fully been implemented and field tested (Mrosek and Balsillie 2001a,b, Mrosek 2002). The complete set is presented in Annex 1.

Criteria and indicators field testing

Within the scope of this paper, only selected C&I field testing results for Principle 2: Yield and quality of goods and services are sustainable, are discussed. Furthermore, only selected results for each indicator are provided. The complete field testing results covering the entire C&I set and indicator verifiers, norms, and assessment are available in Mrosek (2002).

Principle 2: Criterion 2.1 (Forest management provides for sustainability of goods and services)

Concerning Criterion 2.1 (Forest management provides for sustainability of goods and services), results for two indicators are presented.

Indicator 2.1.6 *(Recreational use management provides recreational services while minimizing impact on wildlife and environment)*

The Haliburton Forest offers a wide range of recreational services to the public on a user-fee basis. Activities offered within the recreational use operation are year-round activities such as outdoor education, fishing and birding, summer activities such as seasonal and daily camping, mountainbiking, hiking, daily access, orienteering and canoeing as well as winter activities such as snowmobiling, cross-country skiing, dog sledding and snowshoeing. Additional special educational facilities and activities are the Wolf Centre (an interpretive center including a wolf enclosure), the Canopy Walkway (a boardwalk in the canopy of an eastern white pine (*Pinus strobus* L.) old-growth stand), the Astronomy Observatory, and game farming (Sandberg and Midgley 2000, Schleifenbaum 2000).

Facilities for the recreational use operation comprise nine camps, with the Haliburton Forest Basecamp being the main entrance point and main facility for all activities within the FMU. It consists of more than 20 basic buildings and provides rustic overnight accommodation for up to 100 people. Other facilities are 320 semi-wilderness campsites on 17 of the approximately 50 lakes, with 80 campsites concentrated on MacDonald Lake, 15 daily campsites on five lakes, five shelter cabins, three main lookout locations, various boat landings, and other facilities such as nature interpretative walks and a natural rock climbing wall (Schleifenbaum 2000).

The Haliburton Forest employs a recreational use zoning system in order to manage the spatial distribution and intensity of all usage to minimize impact on wildlife and the environment. The first zone is the high-intensity recreational use zone covering approximately 1% of the total land base. About 90% of visitors use this zone, with about 40% of visitors limiting their activities to this area. The second and third zones are considered average-intensity recreational use zones, and cover approximately 27% of the total land base, contain about 95% of all lakeshore development in the form of campsites, and receive approximately 60% of all visitation. Finally, the fourth zone is the low-intensity recreational, or semi-wilderness, zone covering the remaining area and visited by approximately 20% of all forest users, mostly in the form of snowmobilers during the winter (Sandberg and Midgley 2000, Schleifenbaum 2000).

Although a comprehensive assessment of the carrying capacity of the FMU for recreational activities is lacking, studies have been initiated in order to investigate the potential negative impact of individual recreation use activities.

Indicator 2.1.7 *(Wildlife management provides hunting, trapping and fishing opportunities and is ecologically oriented and sustainable)*

Haliburton Forest is located in Wildlife Management Unit 54 (Ontario Ministry of Natural Resources 2000). The property is divided into 22 hunting zones. Each hunting zone is leased to local individuals who manage hunting camps consisting of an average of 15 to 20 members each. The average hunting-camp size is 1,000 to 1,500 ha. These camps carry out the hunting during the strictly regulated hunting seasons (Ontario Ministry of Natural Resources) for the main game species, white-tailed deer (*Odocoileus virginianus* Zimmerman) (first two weeks of November) and east Canadian moose (*Alces alces americana* Clinton) (third week of November). Hunting is carried out in the form of widely spread forest posts, and with limited use of hunting dogs. No permanent hunting installations are established. In addition, limited hunting takes place for black bear (*Ursus americanus* Pallas), wolf (*Canis lupus* L.), waterfowl, and other small game species. Hunting activities follow not only provincial hunting regulations but guidelines and rules specified by the Haliburton Forest. These guidelines and rules are based on ecological considerations such as natural population levels, structure (e.g. age structure and sex ratio), and health status, as well as sustainable harvest levels. Furthermore, they include a code of conduct for good hunting practices. Part of the wildlife management includes the monitoring of the wildlife populations of selected game species and research of specific wildlife characteristics. Hunting levels have been recorded since 1965. Since 1997, additional variables such as wildlife age and health indices have been assessed during the hunting seasons (Mrosek, Heaven and Wiskow, 1999, Peneston 1997).

Principle 2: Criterion 2.2 (Forest management is socially efficient)

Concerning Criterion 2.2 (Forest management is socially efficient), results for all three indicators are presented.

Indicator 2.2.1 *(Availability and use of recreational opportunities are maintained and other non-timber values are provided)*

As described for Indicator 2.1.6 (Recreational use management provides recreational services while minimizing impact on wildlife and environment), the Haliburton Forest offers a wide range of recreational services. These services are available to the public on a user-fee basis.

The average annual recreational use intensity at the Haliburton Forest is approximately 100,000 visitor days. The greatest use intensity occurs during July and August, with up to 1,000 visitors per day; the lowest use intensity occurs during November and early December, with numbers as low as 10 visitors per day. Not all recreational use types can be expressed in quantitative terms. However, in 1999, selected main recreational activities had use intensities of 30,000 visitor days for the Wolf Centre and 15,000 visitor days for snowmobiling. Other activities such as mountainbiking and hiking had only 200 and 50 visitor days respectively.

Forest management considers and provides a wide range of alternative forest values that are important to visitors of the Haliburton Forest. The assessment of the importance of various timber and non-timber as well as market and non-market forest values is shown in Figure 3.

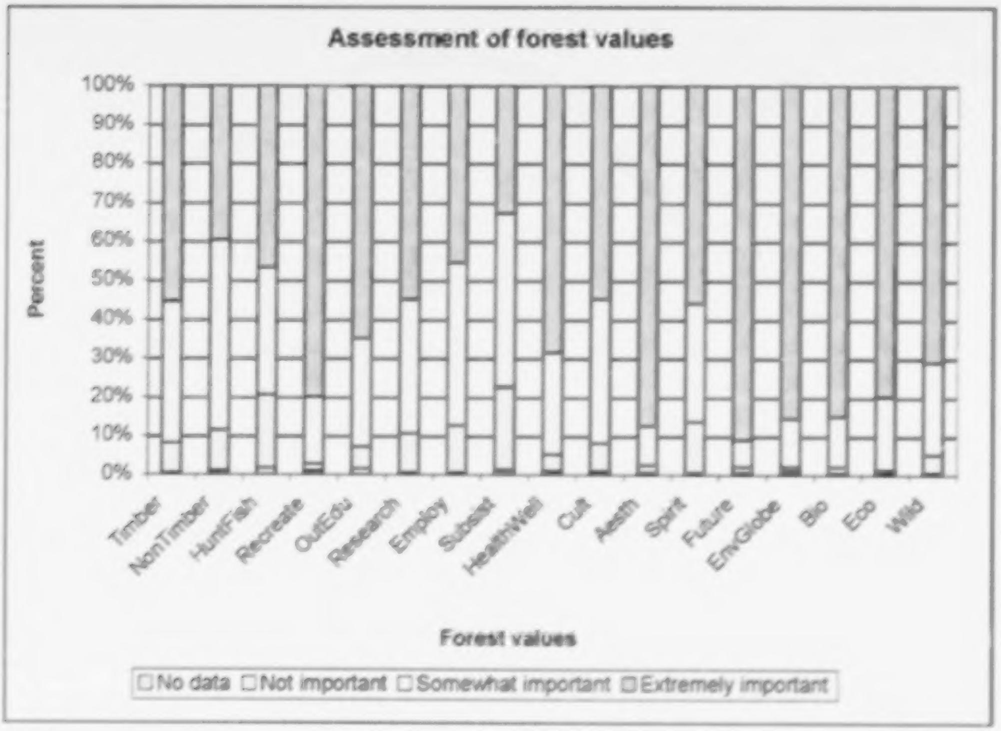


Figure 3. Assessment of the importance of forest products, services and other values by 516 Haliburton Forest visitors, based on a questionaire survey during the year 2000, and applying a forest values classification system

Timber = timber products; NonTimber = non-timber forest products (e.g. berry picking); HuntFish = hunting and fishing; Recreate = recreational opportunities; OutEdu = opportunities for outdoor education; Research = research opportunities; Employ = employment opportunities; Subsist = subsistence land use; HealthWell = promotion of health and sense of well-being; Cult = cultural values; Aesth = aesthetic values; Spirit = spiritual values; Future = opportunities for future generations; EnvGlobe = promotion of environmental quality and global importance of forests; Bio = biological values; Eco = ecological values, and; Wild = wilderness values (Mrosek and Camphausen 2000, Mrosek 2002).

In general, non-timber forest products and services, and other values that are of special importance (more than 80% of visitors surveys ranked them as extremely important) to the users of Haliburton Forest are:

- opportunities for future generations;
- aesthetic values;
- the promotion of environmental quality and global importance of forests;
- biocentric and ecocentric values, and;
- recreational opportunities.

Subsistence land use and hunting and fishing show relatively low rankings (less than 50% of the visitors surveyed ranked these values as extremely important, and more than 20% of visitors surveyed ranked them as not important), followed by others such as employment opportunities and spiritual values.

Indicator 2.2.2 *(Economic importance of non-timber products and services)*

In Figure 4, the development of timber and main non-timber forest products and services is presented individually, showing the diversification of the overall operation over time, and the contribution of each activity to total net income. Net income is defined as revenue minus costs for a specific operation, using cost-allocation tables (Slingerland 2000). Activities include hunting, seasonal camping, daily camping and use of the property, snowmobiling, the Wolf Center, outdoor education, and timber use. Some activities show a positive net income throughout the period assessed, others fluctuate around zero, and others have clear negative values throughout the period. For example, the activity, seasonal camping, was a permanent income source throughout the entire time period, while snowmobiling was an economic loss. The activities, Wolf Center and outdoor education, were major cost factors during the initial investment phase.

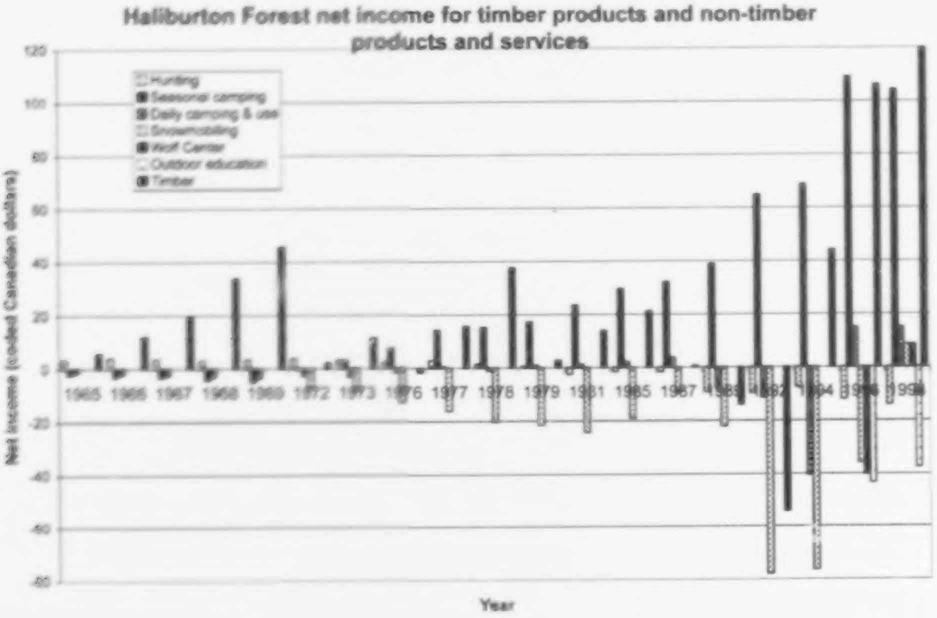


Figure 4. Development of net income from timber products and non-timber forest products and services from 1965 to 1998 (in coded Canadian dollars). Net income = revenue minus costs for a specific operation using cost-allocation tables (Slingerland 2000).

Indicator 2.2.3 *(Existence of economic rents (total management revenues exceed management costs))*

Figure 5 shows the development of the timber and non-timber economic rent ratios from 1965 to 1998. Economic rent is here defined as the difference between total revenue and total expenses expressed in a monetary dollar value. Because this monetary dollar value changes over time in absolute terms, economic rent ratios are used. This economic rent ratio is calculated by dividing the total revenue by the total expenses. Therefore, values greater than one indicate profit, a value equal to one indicates a neutral situation, and values less than one indicate loss. The timber economic rent ratio is based on all forest timber products including the production of eco-log buildings. The non-timber economic rent ratio is an aggregate measure of all non-timber forest products and services (Slingerland 2000).

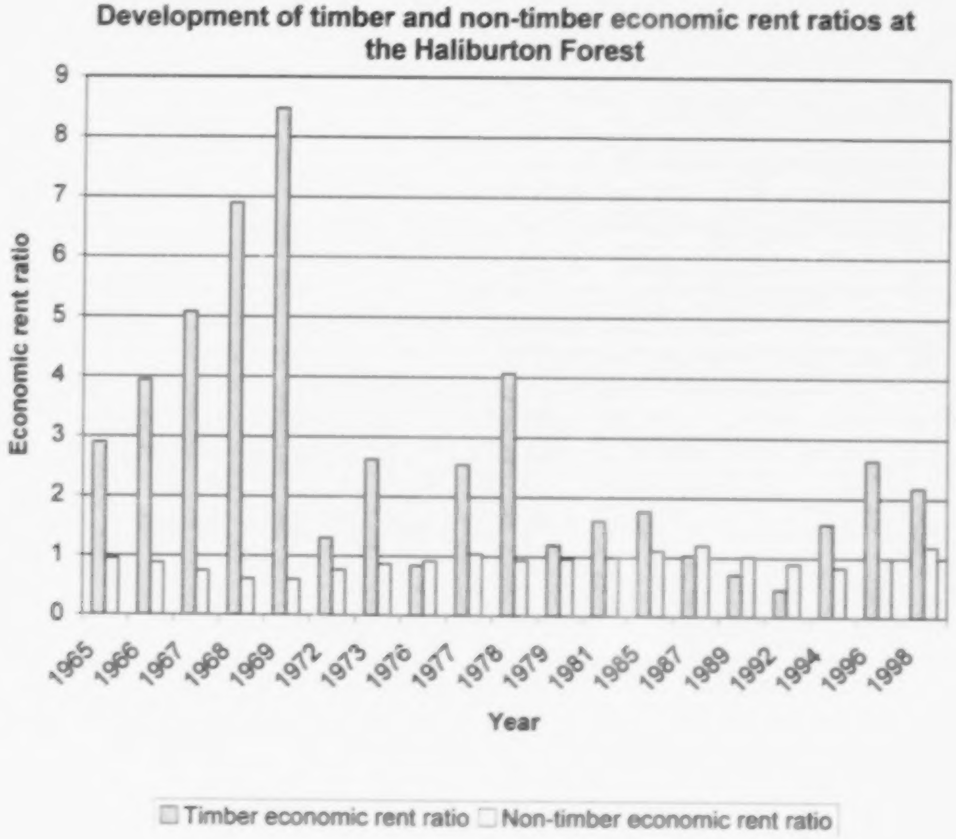


Figure 5. Development of the timber and non-timber rent ratios at the Haliburton Forest. Rent ratio = revenue relative to expenses (> 1 = profit, = 1 = neutral, < 1 = loss); timber = timber and eco-log buildings; non-timber = daily camping and recreational use, hunting, outdoor education, seasonal camping, snowmobiling and Wolf Centre; miscellaneous = other products and services (Slingerland 2000).

The timber economic rent ratios show an increase from 1965 to 1969 as a result of an exploitive high-grading practice. In the beginning of the 1970s, the Haliburton Forest was depleted of commercially valuable saw logs. During the following period, from 1972 to 1998, forest management continually low-graded the forest by extracting low-quality timber and thereby gradually improving stand quality. These low-grading practices reduced the economic rents from the harvesting operations and, in some cases, cause economic losses with a rent ratio smaller than one.

The non-timber economic rents show a period of negative rent ratios from 1965 to 1981. During this time, timber harvesting was the main business and limited recreational use was considered only a minor, secondary product. From 1985 to 1998, integrated and multiple forest use became the management goal of the Haliburton Forest and recreational activities became increasingly important for the operation. New recreational uses were continually added to the Haliburton Forest operation, characterized by investments and subsequent economic losses during 1992 to 1996, but leading to the first significantly increased non-timber economic rents in 1998.

Discussion

The importance of NTFPs has widely been recognized, but the evaluation of the sustainability of NTFPs is still limited to case studies. Some traditional NTFPs in North America and Europe such as recreational use and hunting are well inventoried and monitored, whereas for most of the more recently recognized values such as aesthetic, cultural or environmental values, data is usually lacking. Data requirements for NTFPs are similar for the C&I for SFM, certification and forest management planning. Therefore, the application of standardized measurement methods and the formulation of priorities for data collection are necessary. A minimum measurement standard is the descriptive or quantitative measurement of NTFPs. For example, this could be the number of users or area of use for a given activity or value for a certain time. An advanced measurement standard is the economic (monetary) measurement of market and the sociological evaluation of non-market NTFPs and other values. For sociological evaluations of non-market NTFPs, quantitative methods (e.g. questionnaire survey) should have priority in application due to their easier analysis, comparability and higher cost efficiency, whereas advanced qualitative research methods could be optional.

Within this paper, C&I for the evaluation of the sustainability of NTFPs and the field testing of these indicators in the Haliburton Forest case study have been presented. Based on Haliburton Forest's multiple forest use concept, a unique database for the measurement and monitoring of market and non-market NTFPs has been developed. Although the C&I system could be further optimized in terms of the formulation of indicator norms (baseline or threshold values) and the assessment of the indicators' performance, the long-term data for the wide range of NTFPs already show a clear trend towards the sustainable management of this FMU for NTFPs and other values.

Conclusion

The consideration and provision of NTFPs are important components of SFM. There is a need for further prioritization and standardization of data collection for measuring and monitoring NTFPs among the concepts of C&I for SFM, certification and forest management planning. Despite concepts such as C&I for SFM that allow the measurement and monitoring of NTFPs, further research is required concerning the formulation of corresponding indicator norms and the development of indicator assessment methods. The C&I system for SFM at the local level presented here provides a holistic definition of sustainability and is suitable for the comprehensive evaluation of forests and their management including NTFPs. The Haliburton Forest case study contributes to the field of sustainable forestry by providing a look at the potential future role of NTFPs in the sustainable management of forests internationally.

Acknowledgements

The authors thank Dr. P. Schleifenbaum (Haliburton Forest & Wild Life Reserve Ltd.) for his scientific advice and technical support. We would like to thank E. Slingerland (University of Wageningen, The Netherlands) for his contribution to the economic audit project and A. Camphausen (University of Toronto) for her contribution to the forest values study. We thank Dr. S. Kant (University of Toronto), Dr. H. Schanz (University of Wageningen, The Netherlands), Dr. I. Stefanovic (University of Toronto), and Dr. R. Bürger-Arndt (University of Göttingen, Germany) for valuable discussions. We also thank D. Allen, University of British Columbia, and E. Stewart, chrysalis forestry, for supporting this study. Finally, we would like to thank J. Killen (Trent University) for his assistance in the forest values study field work. This research project has been supported by Haliburton Forest & Wild Life Reserve Ltd. and the Socio-economic Research Group of the University of Toronto.

References

Beckley, T.M.; Boxall, P.C.; Just, L.K.; Wellstead, A.M. 1999. Forest stakeholder attitudes and values: selected social-science contributions. Information Report NOR-X-362, Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta. 24 pp.

Bidinosti, A. 1998. Understanding forest values: Canada's Model Forest Program. MSc thesis, University of Manitoba. The Natural Resource Institute, Winnipeg, Canada. 189 pp.

Center for International Forestry Research (CIFOR). 1999. The CIFOR criteria and indicators generic template. The criteria and indicators toolbox series No. 2. Center for International Forestry Research, Bogor, Indonesia. 53 pp.

Davies, L. S.; Johnson, K. N.; Bettinger, P. S.; Howard, T. E. 2001. Forest management. To sustain ecological, economic and social values. McGraw-Hill, New York. 816 pp.

Drengson, A.; Taylor, D. 1997. Shifting values. Seeing forests and not just treeS. In Wellington, A., Greenbaum, A., & Cragg, W. (Eds.), Canadian issues in environmental ethics. Broadview Press, Peterborough. pp. 35-49.

Ferguson, I. S. 1996. Sustainable forest management. Oxford University Press, Melbourne. 162 pp.

Forest Stewardship Council. 2000. FSC Principles and Criteria. Forest Stewardship Council. (http://www.fscoax.org/principal.htm). February 2001.

Kohm, K. A.; Franklin, J. F. (Eds.). 1997. Creating a forestry for the 21st century: the science of ecosystem management. Island Press, Washington. 475 pp.

Montreal Process Liaison Office – Canadian Forest Service. 2000. The Montreal Process: Year 2000 Progress Report. Montreal Process Liaison Office – Canadian Forest Service, Ottawa. 87 pp.

Mrosek, T. 2002. Development and testing of a criteria and indicators system for sustainable forest management at the local level. Case study at the Haliburton Forest & Wild Life Reserve Ltd., Canada. Ph.D. thesis, University of Toronto, Faculty of Forestry, Toronto. 206 pp.

Mrosek, T. 2001. Developing and testing of a method for the analysis and assessment of multiple forest use from a forest conservation perspective. Forest Ecology and Management 140: 65–74.

Mrosek, T. 1998. Prozeßschutzkonzept für einen kanadischen Privatforstbetrieb [Application of the concept of protection of natural processes at a Canadian private forest]. Allgemeine Forst Zeitschrift/Der Wald 24: 1499–1501.

Mrosek, T.; Balsillie, D. 2001a. Development and testing of a criteria and indicators system for sustainable forest management at the forest management unit level. Case study at the Haliburton Forest & Wild Life Reserve Ltd., Ontario, Canada. In Franc, A, Laroussinie, O., & Karjalainen, T. (Eds.), Criteria and Indicators for Sustainable Management at the Forest Management Unit Level. European Forest Institute, Joensuu. pp. 215–236.

Mrosek, T.; Balsillie, D. 2001b. Kriterien und Indikatoren einer nachhaltigen Waldbewirtschaftung auf Forstbetriebsebene [Criteria and indicators for sustainable forest management at the forest management unit level]. Allgemeine Forst Zeitschrift – Der Wald 4: 193–195.

Mrosek, T.; Camphausen, A. 2000. Evaluation of human values associated with forests and public participation in forest management. Progress Report. University of Toronto, Faculty of Forestry, Toronto. 36 pp.

Mrosek, T.; Heaven, I.; Wiskow, H. 1999. Evaluation of the biodiversity of Haliburton Forest & Wild Life Reserve Ltd. Technical Report 1999. Haliburton Forest & Wild Life Reserve Ltd., Haliburton, Canada. 114 pp.

Ontario Ministry of Natural Resources. 2000. Deer wintering areas in wildlife management units adjacent to Algonquin Park. Queen's Printer, Bracebridge. 1 p.

Pan-European Forest Certification Council. 2000. Pan-European forest certification framework. Common elements and requirements. Technical document.(http://www.pefc.org/Ramme2.htm). February 2001.

Peneston, W. 1997. Haliburton Forest & Wildlife Reserve Moose and Deer Harvest Report 1997. Hocking College – School of Natural Resources, Nelsonville. 5 pp.

Sandberg, L. A.; Midgley C. 2000. Recreation, forestry and environmental management: The Haliburton Forest & Wild Life Reserve, Ontario, Canada. In: Font, X. and Tribe J. (ed.) Forest tourism and recreation. Case studies in environmental management. CABI, Wallingford, UK. pp. 201–215.

Schleifenbaum, P. 2000. Resource management plan for the private property of Haliburton Forest & Wild Life Reserve Ltd. 2000-2004. Haliburton Forest & Wild Life Reserve Ltd., Haliburton, Canada. 204 pp.

Slingerland, E. 2000. Analysis and assessment of the economic sustainability of forest management; a case study at Haliburton Forest & Wild Life Reserve Ltd, Ontario, Canada. M.Sc. thesis, University of Wageningen, Wageningen, The Netherlands. 73 pp.

SmartWood. 1998. SmartWood certified forestry. Practical conservation through certified forestry. Smart Wood, Richmond, U.S.A. 8 pp.

Von Gadow, K.; Pakkula, T.; Tome, M. 2000. Sustainable forest management. Kluwer Academic Publishers, Dordrecht. 368 pp.

Third Ministerial Conference on the Protection of Forests in Europe Liaison Unit in Lisbon (Eds.). 1998. Third Ministerial Conference on the Protection of Forests in Europe. General declarations and resolutions adopted. Third Ministerial Conference on the Protection of Forests in Europe Liaison Unit in Lisbon, Lisbon. 64 pp.

Wiersum, K. F. 1995. 200 years of sustainability in forestry: Lessons from history. Environmental Management 19 (3): 321–329.

Wijewardana, D.; Caswell, S.; Palmberg-Lerche, C. 1998. Criteria and indicators for sustainable forest management. XI World Forestry Congress. Antalya, Turkey, 13 to 22 October 1997, Proceedings, Volume 6, Section G. Policies, Institutions and Means for Sustainable Forestry Development. <http://www.fao.org/montes/foda/wforcong/PUBLI/V6/T0E/1.HTM#TOP>. February 2001.

Woodley, S.; Alward, G.; Gutierrez, L. I.; Hoekstra, T.; Holt, B.; Livingston, L.; Loo, J.; Skibicki, A.; Williams, C.; Wright, P. 1998a. North American test of criteria and indicators of sustainable forestry. Final report, Volume 1. Center for International Forestry Research, Bogor, Indonesia. 127 pp.

Woodley, S.; Alward, G.; Gutierrez, L. I.; Hoekstra, T.; Holt, B.; Livingston, L.; Loo, J.; Skibicki, A.; Williams, C.; Wright, P. 1998b. North American test of criteria and indicators of sustainable forestry. Final report, Volume 2. Center for International Forestry Research, Bogor, Indonesia. 578 pp.

Annex 1

Generic C&I set for SFM at the local level in temperate forests (P = principle, C = criterion, I = indicator)

P	C	I		Source
1	**Ecological integrity is maintained**			NAT
	1.1	Landscape patterns are maintained		NAT
		1.1.1	Level of forest fragmentation and connectedness of forest components	NAT
		1.1.2	Road network density, type and use	NAT (mod.)
		1.1.3	Extent to which forest management considers the protection of unique or significant landscape level features	New
	1.2	Ecosystem diversity is maintained		NAT
		1.2.1	Area of forest land converted to non-forest land cover	NAT (mod.)
		1.2.2	Area of vegetation types and structural classes relative to the historical condition and total forest area	NAT
		1.2.3	Representation of selected key and sensitive guilds occur in the community guild structure	NAT
	1.3	Ecosystem function is maintained		NAT
		1.3.1	Area of representative protected areas for enabling natural processes as well as habitat and species conservation	CIFOR (mod.)
		1.3.2	Ecologically sensitive areas are protected (e.g. buffer zones along water courses)	NAT
		1.3.3	Coarse woody debris and snags retained at functional levels	NAT
		1.3.4	Area and severity of natural disturbances such as storm, insects and wildfire	NAT (mod.)
	1.4	Native species diversity is maintained		NAT
		1.4.1	Populations of indigenous species are likely to persist	NAT
		1.4.2	Number of known indigenous species classified as extinct, extirpated, endangered, threatened or vulnerable relative to the total number of indigenous species	NAT (mod.)
		1.4.3	Species protection and restoration programs for endangered, threatened, vulnerable or rare species	CIFOR (mod.)
	1.5	Genetic diversity is maintained		NAT
		1.5.1	Population sizes and reproductive success are adequate to maintain levels of genetic diversity	NAT
		1.5.2	Use of natural regeneration and of scientifically-based seed transfer rules and seed orchard zones in planting native species	NAT (mod.)
		1.5.3	Management does not significantly change gene frequencies	NAT
	1.6	Physical environmental factors		NAT
		1.6.1	Area of harvested area with degraded soil quality (e.g. soil compaction, displacement, erosion, puddling and loss of organic matter)	NAT (mod.)
		1.6.2	There is no significant change in the quality and quantity of water from the forest catchment	CIFOR
	1.7	Incidence of disturbance and stress		NAT
		1.7.1	Area and severity of occurrence of exotic species detrimental to forest condition	NAT
		1.7.2	Pollutant levels (e.g. airborne pollution) and chemical contamination (e.g. pesticides) in the ecosystem	NAT (mod.)

2	**Yield and quality of goods and services are sustainable**	**NAT**
2.1	Forest management provides for sustainability of goods and services	NAT
2.1.1	Land base available for timber production	NAT (mod.)
2.1.2	Mean annual increment for forest type and age class	NAT
2.1.3	Annual and periodic removals of timber and non-timber forest products by area and/or volume relative to sustainable levels	NAT (mod.)
2.1.4	Silvicultural systems are appropriate to forest type, production of desired products and condition, and assure forest establishment, composition and growth	NAT
2.1.5	Harvesting systems and equipment match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions and water quality and quantity	NAT
2.1.6	Recreational use management provides recreational services while minimizing impact on wildlife and environment	New
2.1.7	Wildlife management provides hunting, trapping and fishing opportunities and is ecologically oriented and sustainable	New
2.2	Forest management is socially efficient	NAT
2.2.1	Availability and use of recreational opportunities are maintained and other non-timber values are provided	NAT (mod.)
2.2.2	Economic importance of non-timber products and services	NAT (mod.)
2.2.3	Existence of economic rents (total management revenues exceed management costs)	NAT (mod.)
3	**Society accepts responsibility for sustainability**	**NAT**
3.1	Forest management provides ongoing access to the resource	NAT
3.1.1	Access to forest resources is fair and secure	NAT (mod.)
3.1.2	Ownership and use rights and responsibilities to resources (inter- and intra-generational) are clear and respect pre-existing claims	NAT
3.2	Concerned stakeholders have a right to participate in open and meaningful public participation processes in order to influence management	NAT
3.2.1	The public participation process should be inclusive with all interests represented	NAT
3.2.2	Stakeholders have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process	NAT
3.2.3	Management staff and stakeholders should recognize and respect the interests and rights of each other	NAT
3.2.4	The decision-making process is transparent and considers the interests and values of stakeholders	NAT (mod.)
3.2.5	Extent to which forest management considers the protection of unique or significant sites of social, cultural, spiritual or scientific importance	New
3.3	Recognition and respect for Aboriginal roles in sustainable forest management (Aboriginal rights, Treaty rights and aboriginal values)	NAT
3.3.1	Extend to which forest management considers and meets legal obligations concerning duly established Aboriginal and treaty rights	NAT
3.3.2	Extent of Aboriginal participation in forest-based opportunities	NAT (mod.)

	3.3.3	Extent to which forest management considers the protection of unique or significant Aboriginal social, cultural or spiritual sites	NAT (mod.)
	3.3.4	Area of land available for subsistence purposes	NAT
3.4		There is equitable access to and distribution of economic rents	NAT
	3.4.1	Economic importance of FMU for local communities	NAT (mod.)
	3.4.2	Employment of local population at FMU	NAT (mod.)
	3.4.3	Distribution of rent capture	NAT (mod.)
	3.4.4	Mechanisms exist for sharing economic benefits	NAT
	3.4.5	Wages and other benefits conform to regional, national or international minimum standards	NAT (mod.)
3.5		Forest based human health issues	NAT
	3.5.1	Forestry employer follows regional, national or international working and safety standards and takes responsibility for forest-related health risks of workers	NAT
	3.5.2	Forest management cooperates with public health authorities concerning forest-related illnesses	NAT (mod.)
4		**Enabling conditions for sustainable forest management**	NAT
4.1		Policy, planning and institutional framework are conducive to sustainable forest management	NAT
	4.1.1	Forest management considers and meets legal forestry requirements and standards	New
	4.1.2	There is sustained and adequate funding and staff for forest management	NAT
	4.1.3	Policy and planning are based on recent and accurate information	NAT
	4.1.4	Objectives are clearly stated concerning major functional forest areas	NAT
	4.1.5	Effective instruments for inter-institutional coordination on land use and forest management exists	NAT
	4.1.6	Institutions responsible for research are adequately funded and staffed	NAT
4.2		The management plan is implemented and effective in moving toward stated goals	NAT
	4.2.1	Continuous inventories established and measured regularly	NAT
	4.2.2	Documentation and records of all forest management activities are kept in a form that makes monitoring possible	NAT
	4.2.3	Actual vs. planned performance is measured and recorded	NAT
	4.2.4	An effective monitoring and control system audits management's conformity with planning	NAT

Source: NAT = North American test; CIFOR = Center for International Forestry Research; New = newly developed (Mrosek & Balsillie, 2001a &b; Mrosek, 2002; modified and extended from Woodley et al., 1998a & b; CIFOR, 1999).

Sustainable roundwood supply in the Republic of Korea

Woo-Kyun Lee

Division of Environmental Science and Ecological Engineering,
Korea University, Seoul, 136-701 KOREA
Tel: +2 3290-3016, Fax: +2 953-0737, Email: leewk@korea.ac.kr

Abstract

The timber market of Republic of Korea can be characterized as being (1) import-oriented supply and (2) domestic-oriented demand. Recently, import patterns have also been changing as follows: (3) from hardwood to softwood, (4) from high to low quality, and (5) from roundwood to wood products. These five characteristics indicate that the Republic of Korea is a typical country importing wood-based raw materials that today faces difficulties in securing a sustainable supply of roundwood through both its domestic production and imports.

As a method for meeting the needs of environmental protection while securing a stable supply of wood-based materials, the establishment of tree plantations overseas has been decided upon by both Korean companies and the government. This decision is primarily aimed at ensuring a sustainable supply of wood materials. The Korean government also aims to avoid the disadvantages of being a net log importer and to gain a good reputation as a country that contributes to preserving the global environment.

When establishing these plantations there are basic principles proposed by the government. Fast-growing tree species are to be favoured and countries that are geographically close preferred. In this case, the political and economic safety of investments needs to be secured. To ensure the security of investment, a series of security pacts with partner countries have been agreed. For investment safety, from the economic viewpoint, reports detailing the investment environments of various countries such as Malaysia, Vietnam, Myanmar, New Zealand, Australia, Solomon Islands, Papua New Guinea, Chile, and China have been issued. The Korean government finances corporations and personal investors that plan to establish tree plantations overseas. Between 90% and 100% of the establishment costs are financed with an interest rate of 3%. The financing period is 10 to 20 years for fast-growing tree species and 28 years for tree species with longer rotations.

Keywords: *Timber markets, Republic of Korea, environment protection, export restriction, sustainable supply of roundwood, plantation establishment, support policies.*

Introduction

The Republic of Korea holds relatively poor forest resources compared with other Asian countries. As of 2000, in the Republic of Korea about 65% of the total land area was covered with forested land, of which about 80% was afforested during the last 30 years. This has resulted in a relatively young stage of forest. Consequently, the average wood stock per hectare is very low at about 63 m^3 (as of 2000). This young

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

forest with poor stock is not expected to supply enough wood material to meet the national demand for many years.

The Republic of Korea is inevitably a consumer of wood-based materials. In 2003, about 90% of all roundwood used was being imported with increasing difficulties being experienced in importing roundwood due to increases in log-export restrictions in producer countries and world-wide concerns about environmental protection.

The objective of this paper is to review the import trends of roundwood and to examine various strategies for ensuring a long-term sustainable forest product supply to the Republic of Korea.

Demand for roundwood in the Republic of Korea

The total roundwood demand in the Republic of Korea increased dramatically in the early 1970s, peaked in 1978, and then decreased rapidly until 1982. Since then total demand for roundwood has tended to increase slightly, showing fairly similar trends to the domestic demand (Figure 1).

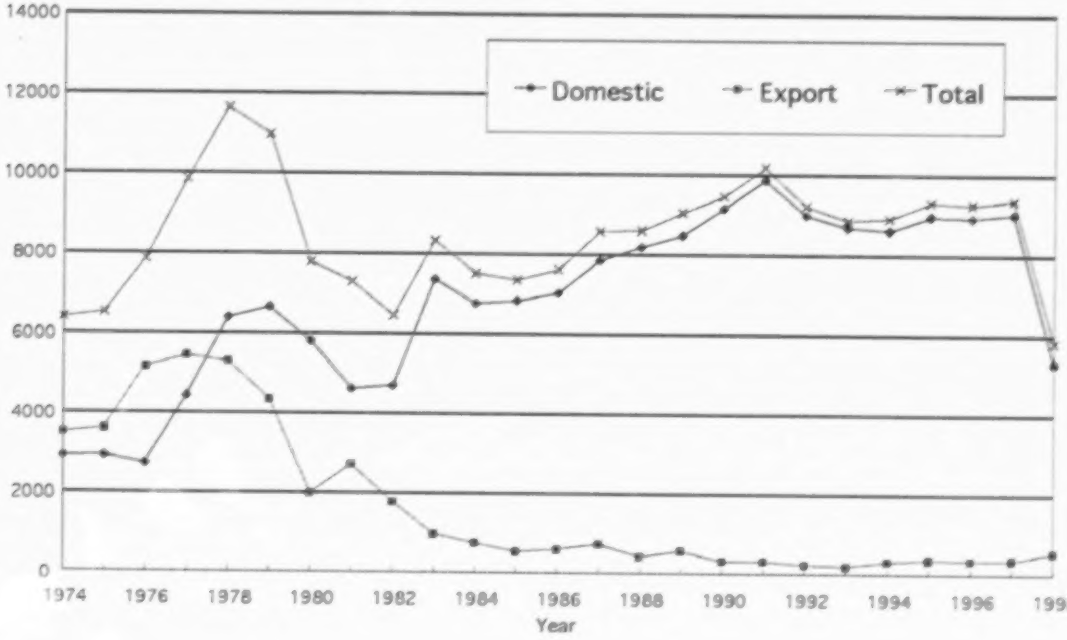


Figure 1. Total demand of roundwood (*Source: KFS 1999*)

Figure 1 shows the demand for roundwood in the export sector increasing until 1977, exceeding the demand for domestic use. In the mid 1970s, about 60–70% of the total roundwood consumption occurred in wood-based industries, especially plywood production for export. After reaching the maximum in 1977, demand for roundwood in the export sector began to decrease and dropped to 300 000 m^3 in 1990. Since then the demand for roundwood for export has remained fairly constant.

In contrast, the domestic demand for roundwood has steadily increased since 1994. From 1976 to 1979, it drastically increased with a drop towards 1981 during the 'oil shock' period (1979 to 1981). Since 1981, the domestic demand for roundwood has increased slightly, determining the trend of total demand for roundwood. The demand for roundwood for domestic use in 1997 increased about 104% of its value in 1977, while the demand for export in 1997 decreased about 94% over the same period.

The economic crisis that began in 1997 caused a dramatic decline in the domestic and total demand for roundwood in 1998, while the demand for roundwood in export-oriented industries increased a little, perhaps due to the devaluation of the Korean currency and the consequent price competitiveness of wood products made in Korea.

Demand for domestic use

The total domestic demand for roundwood (Figure 2) shows a generally increasing trend, with a high level of sensitivity to the demand for sawnwood, mainly by the domestic construction industry.

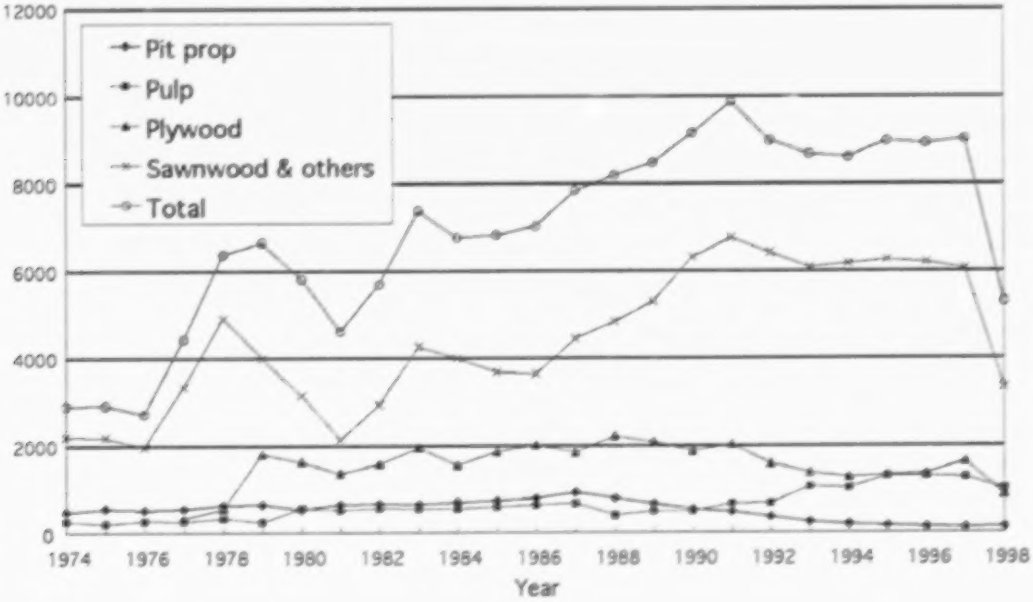


Figure 2. The domestic demand for roundwood in the Republic of Korea (1974-1998)

Figure 2 shows the yearly fluctuation of domestic demand (1974 to 1998) was very similar to the demand for sawnwood. The roundwood demand for pit prop, plywood and pulp has stayed almost constant during this period, with little influence on the trend of domestic demand. Here we can see that the roundwood market in the Republic of Korea is heavily dependant on the domestic construction industry.

Demand for export use

The total export demand for roundwood between 1974 and 1998 followed a pattern similar to export demand for plywood until the mid-1980s. Since then, it has shown a rather similar pattern to the export demand for sawnwood, which has remained almost unchanged over the period (Figure 3).

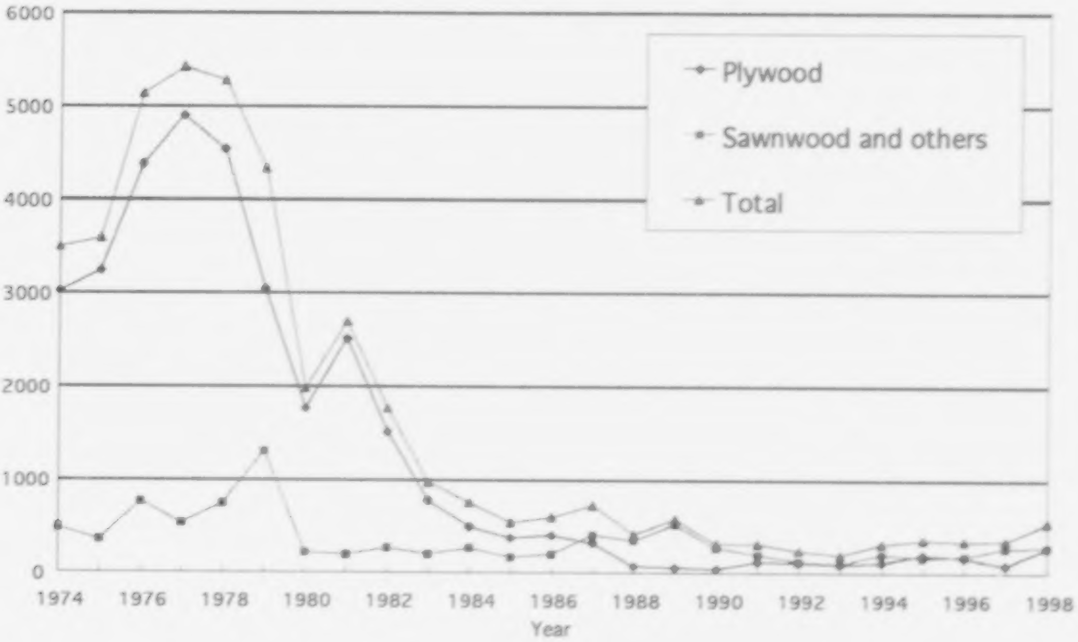


Figure 3. The export demand for roundwood from the Republic of Korea (1974-1998)

Up to the mid-1980s, most of the roundwood in the export sector had been used for producing plywood. During the 1970s, the wood-based market in the Republic of Korea was dependant on the plywood-processing industry. During this time, roundwood was imported from Southeast Asia and processed to plywood to be re-exported (KFRI 1997b). The demand for roundwood in the export-oriented plywood industry declined markedly after 1977, causing a decrease in the demand for roundwood in the export sector. This was combined with the non-export policy of roundwood in the producer countries from the late 1970s (KFRI 1997b). Various policies prohibiting log exports in the producer countries caused an increase in the price of roundwood on the international log market, creating difficulties in the availability of overseas roundwood to the Republic of Korea. In the long run, this resulted in the competitive power of Korean plywood being weakened in the international market, the plywood industry in the Republic of Korea declining, and the demand for roundwood for plywood subsequently reduced.

Supply of roundwood

Figure 4 represents the trend of roundwood supply in the Republic of Korea from 1974 to 1998. As a whole, the import of roundwood shows an increasing trend, fluctuating between 6 million and 8 million m^3. In contrast, the domestic supply of roundwood remained almost constant at around one million m^3. The increasing rate of roundwood being imported between 1980 and 1997 amounts to about 35%, while roundwood supplied domestically increased only 5% over the same period. Most of the roundwood demand in the Republic of Korea has been met by imports with only about 12% to 15% supplied domestically.

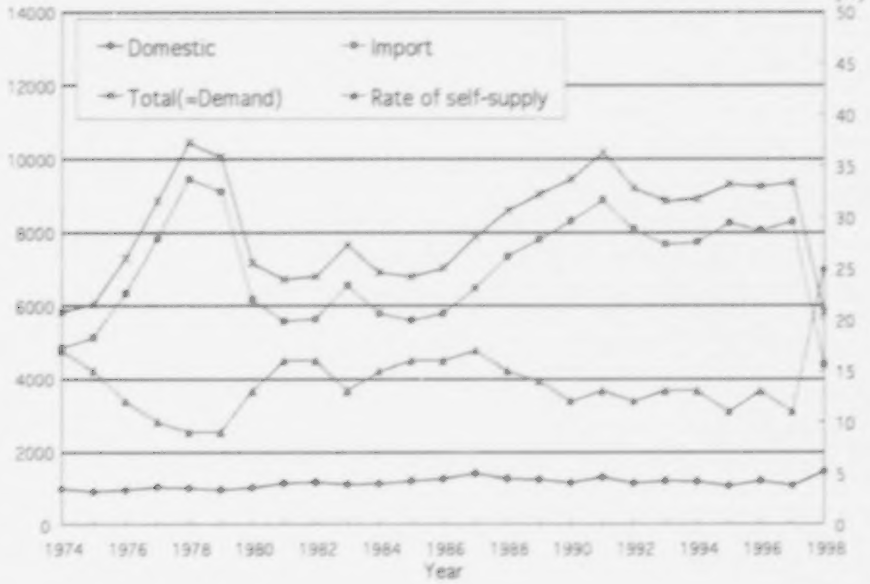


Figure 4. Total supply of roundwood to the Republic of Korea (*Source: KFS 1999*)

Domestic supply of roundwood

The domestic supply of roundwood between 1974 and 1998 shows a trend similar to that of pit-prop use until 1990 (Figure 5), indicating that most of the roundwood supplied domestically had been used for pit prop over the period.

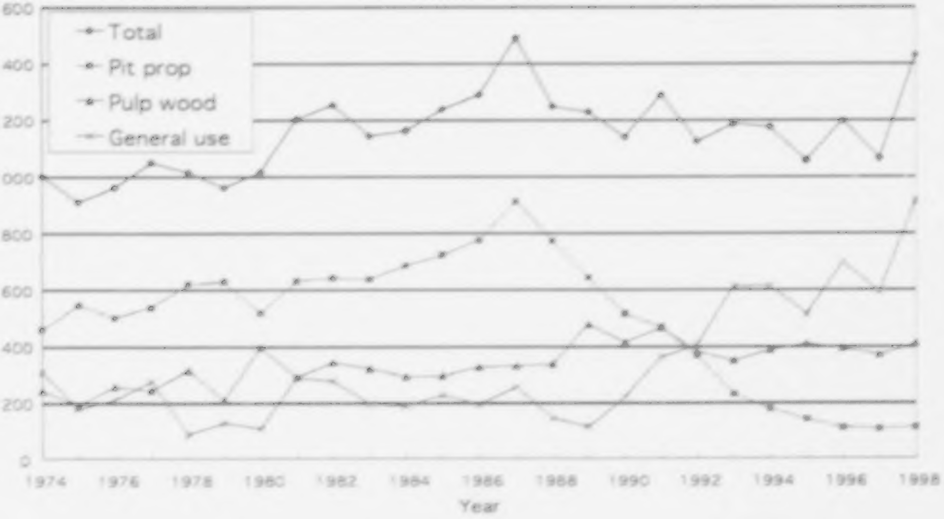


Figure 5. Total domestic supply of roundwood to the Republic of Korea (*Source: KFS 1999*)

Roundwood supply by importation

Figure 6 shows the roundwood supply from overseas and its uses. The importation of roundwood followed a similar trend to its export use in the 1970s and its domestic use during the 1980s and 1990s.

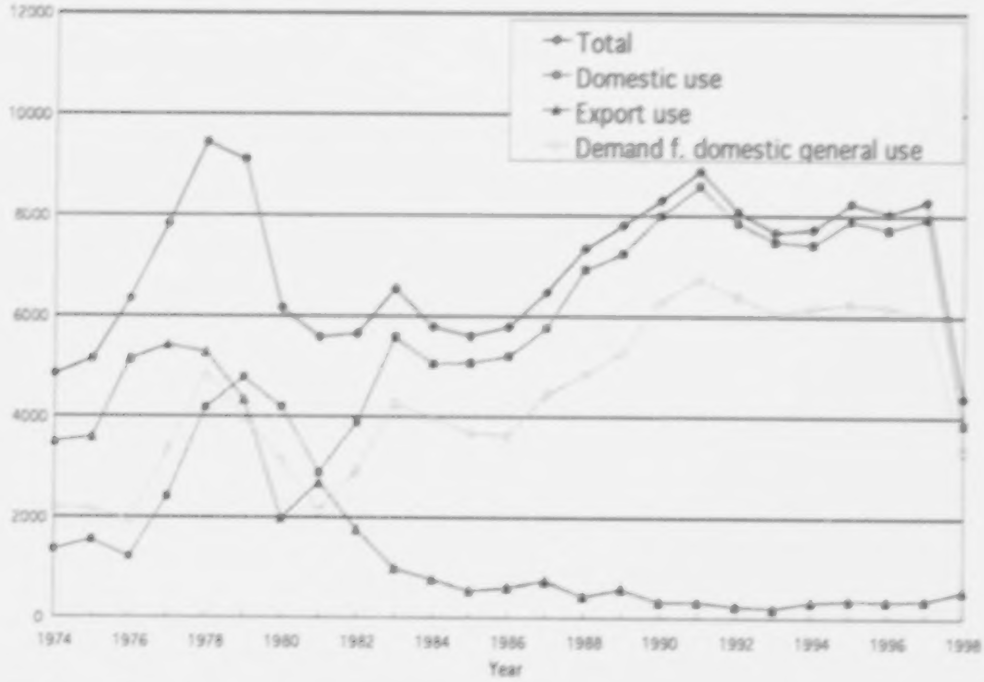


Figure 6. Total import supply of roundwood to the Republic of Korea (*Source: KFS 1999*)

From 1974 to 1978, most imported roundwood had been used for producing plywood to be re-exported. However the use of imported roundwood in the export sector decreased markedly from about 5 million to 500 000 m^3 between 1978 and 1985, remaining between 500 000 to 600 000 m^3 until 1989, and dropping to around 300 000 m^3 between 1990 and 1998. In contrast, the domestic use of imported roundwood has increased steadily since 1981. From 1981 to 1997, the volume of domestically imported roundwood increased by about 175%, while the volume for export use decreased by about 87% over the same period. Today, most imported roundwood is used for domestic wood-based industries, especially for producing sawnwood (used mainly for construction activities).

Roundwood importation by region

Importing hardwood from Southeast Asian countries such as the Philippines, Malaysia, and Indonesia decreased steadily from 1977 to 1997, while softwood imports from other nations such as New Zealand, Chile, the U.S., and Russia have increased. Since 1989, imported log volume from temperate or boreal regions has exceeded that from Southeast Asian countries (Figure 7).

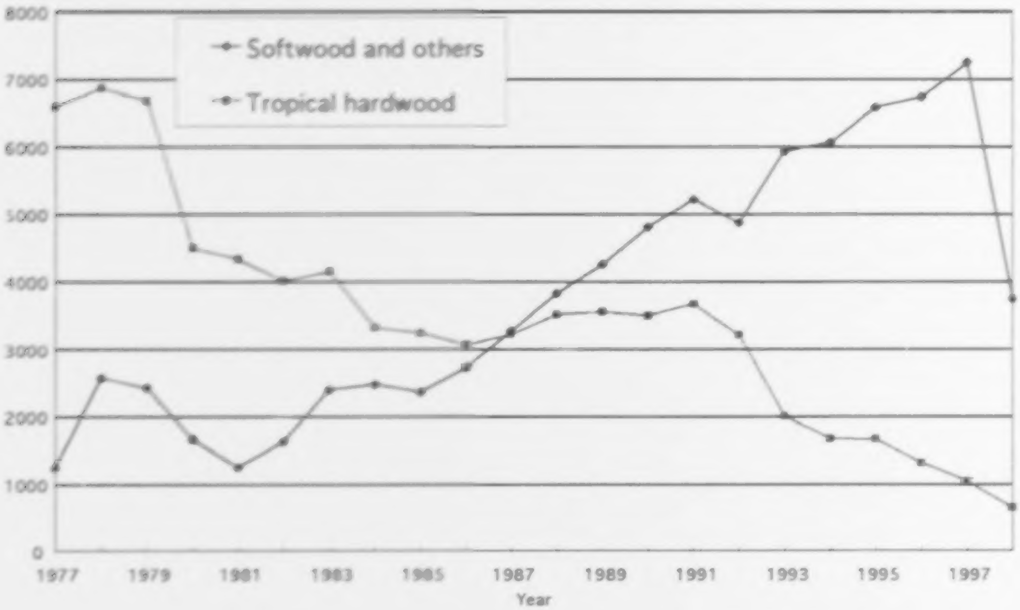


Figure 7. Roundwood imports (soft and hardwood) to the Republic of Korea (*Source: KFS 1999*)

Tropical hardwood was imported mainly from Indonesia, Malaysia, and Philippines until the mid 1980s (Figure 8). However, between 1978 and 1982, imports of roundwood from Indonesia drastically decreased, with no roundwood imported from Indonesia since 1985.

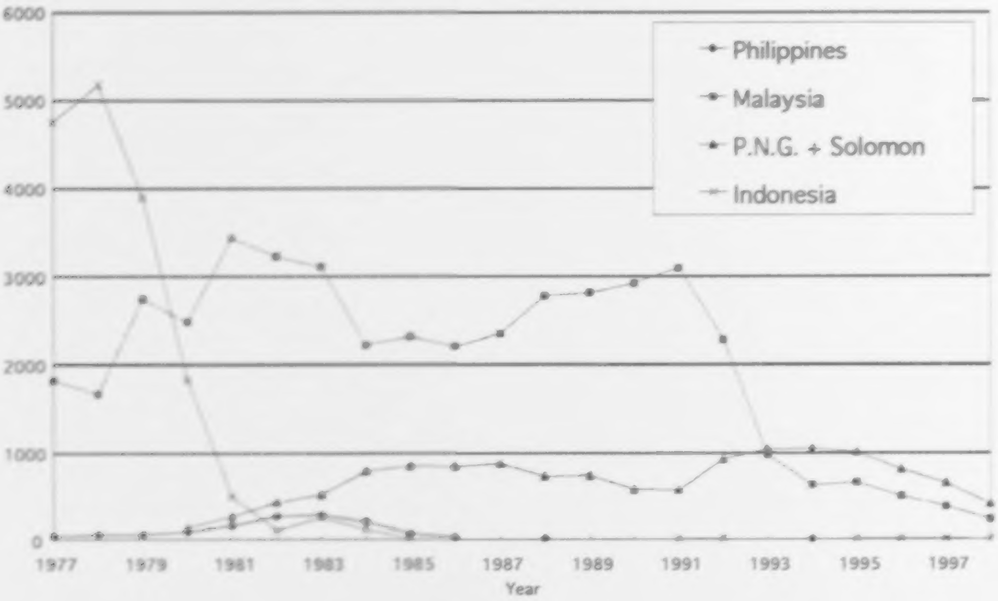


Figure 8. Hardwood roundwood imported to the Republic of Korea (*Source: KFS 1999*)

Figure 8 shows that a small quantity of roundwood was imported from the Philippines up until 1986. Since then there has been no more roundwood trade with the Philippines. Around 2–3 million m^3 of roundwood were imported annually from Malaysia between 1977 and 1992, representing the highest ranking volume of roundwood imported from tropical lands. However this volume dropped to about 1 million m^3 in 1993 and continued to decrease so that only 300 000 m^3 of roundwood was imported from Malaysia in 1998. During the past 20 years, importation of roundwood from PNG including the Solomon Islands has increased somewhat, making up about 60% of the tropical roundwood that imported in 1998.

Partner countries for importing softwood have changed from the U.S. to New Zealand, Chile, and Russia (Figure 9). Up until the early 1990s, most softwood logs had been imported from the U.S. Softwood log imports from the U.S. increased until 1989 and then began to drastically decrease, while imports from New Zealand, Chile, and Russia went up. Today, most softwood logs are imported from New Zealand (46%) and Chile (24%). About 11% of softwood logs are imported from the U.S. and Russia, representing a decreasing trend from the U.S., and an increasing trend from Russia.

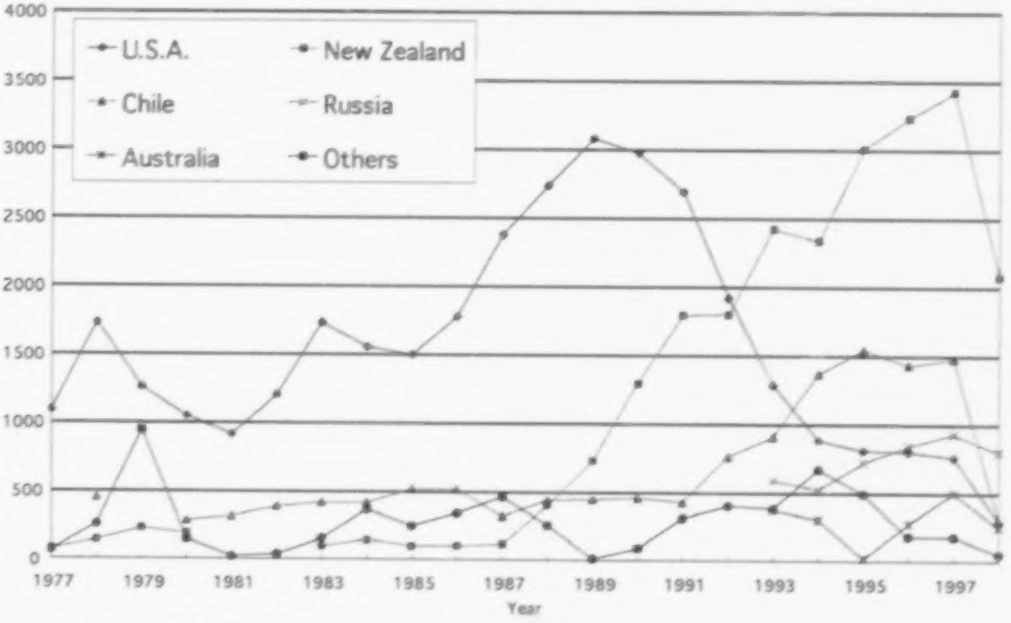


Figure 9. Major exporters of roundwood to the Republic of Korea (*Source: KFS 1999*)

Roundwood import by tree species

The main tree species of imported roundwood to the Republic of Korea has changed from tropical hardwood to temperate and boreal softwood. The ratio of tropical hardwood imports has declined sharply, whereas the volume of softwood has increased. Of the roundwood volume imported in 1980, 73% was tropical hardwood and 27% temperate softwood. This had changed by 1997, so that tropical hardwood amounted to only 16% and temperate and boreal softwood comprised about 84% of imported roundwood (Figure 7). Correspondingly, there have also been changes in tree species and quality, with a trend from high to low quality. In case of hardwood, Lauan of high quality has been substituted with Keruing and finally MLH (Mixed Light Hardwoods) of relatively low quality. In softwood logs, high-quality Douglas-fir, mainly imported from the U.S., has been substituted with low-quality radiata pine from New Zealand and spruce from Russia (Table 1).

Table 1: Percent of imported roundwood by tree species and year (numbers in parentheses are percentages of total hardwood or total softwood for that year).

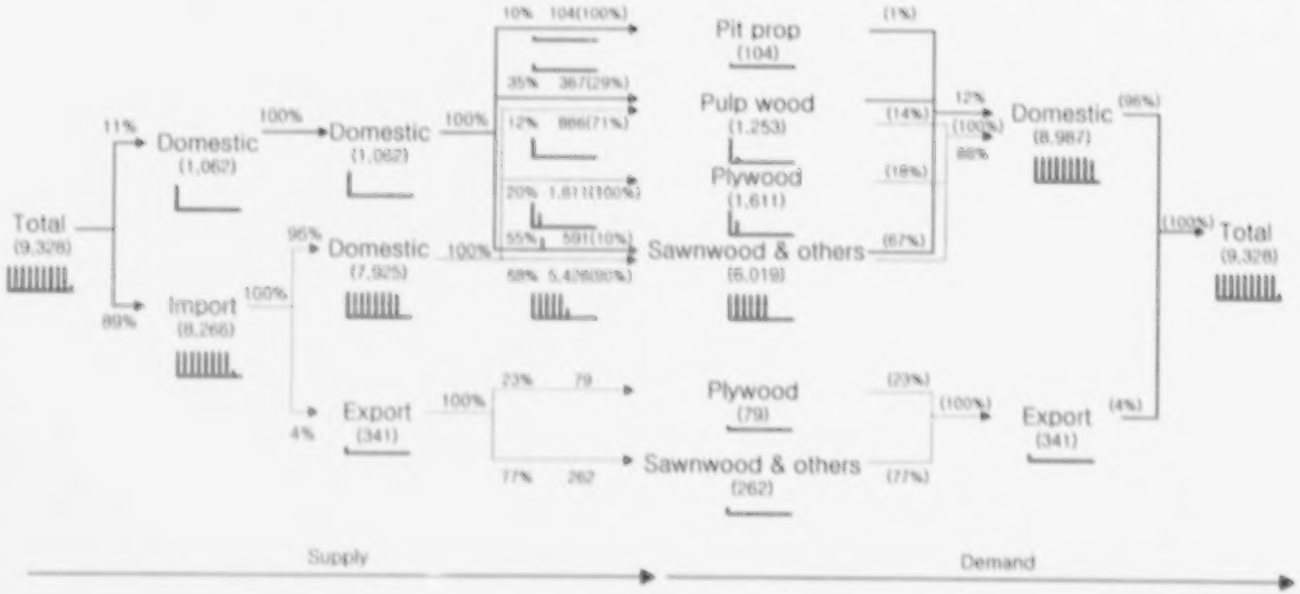
Year	91	92	93	94	95	96	97	98
Volume (1 000m^3)	8 861	8 059	7 648	7 710	8 229	8 030	8 266	4 370
Softwood (%)	56.7(100)	58.4(100)	70.7(100)	73.9(100)	76.8(100)	82.9(100)	84.3(100)	81.1(100)
Douglas-fir	25.6(45.1)	23.7(40.6)	15.5(21.9)	9.4(12.7)	6.9 (9.0)	6.8 (8.2)	5.5 (6.5)	3.3 (4.1)
Radiata pine	18.9(33.3)	24.6(42.1)	34.5(48.8)	47.6(64.4)	54.2(70.6)	60.1(72.5)	60.4(71.6)	56.5(69.7)
Fir	0.9 (1.6)	1.3 (2.2)	1.7 (2.4)	1.2 (1.6)	1.8 (2.3)	1.9 (2.3)	5.4 (6.4)	7.8 (9.6)
Spruce	1.0 (1.8)	1.0 (1.7)	4.2 (5.9)	3.7 (5.0)	4.0 (6.8)	5.6 (6.8)	5.0 (5.9)	5.9 (7.3)
Others	10.3(18.2)	7.8(13.4)	14.8(20.9)	12.0(16.2)	9.9(10.3)	8.5(10.3)	8.0 (9.5)	7.6 (9.4)
Hardwood (%)	43.3(100)	41.6(100)	29.3(100)	26.1(100)	23.2(100)	17.1(100)	15.7(100)	18.9(100)
Lauan	3.9 (9.0)	1.7 (4.1)	0.7 (2.4)	0.4 (1.5)	0.5 (2.2)	0.4 (2.3)	0.6 (3.8)	0.4 (2.1)
Keruing	12.2 (28.2)	10.2(24.5)	2.5 (8.5)	1.4 (5.4)	1.0 (4.3)	1.2 (7.0)	0.8 (5.1)	1.8 (9.5)
MLH & Others	27.2 (62.8)	29.7(71.4)	26.1(89.1)	24.3(93.1)	21.7(93.5)	15.5(90.6)	14.3(91.1)	16.7(88.4)

Source: Korea Forest Service (KFS),(1999)

Flow of roundwood in the Republic of Korea in 1997

Figure 10 represents the marketing flow of roundwood in the Republic of Korea in 1997. Roundwood supplied domestically was consumed domestically. For 1997, roundwood production totalled 1.06 million m^3, of which 55% was used for sawnwood and other wood products, 35% for pulpwood, and 10% for pit prop.

Of the imported roundwood, amounting to 9.33 million m^3, about 96% was consumed domestically, while only 4% was used for sawnwood and plywood to be re-exported. All roundwood demanded for exports was imported. Of the domestic consumption of imported roundwood, about 68% was used for sawnwood and other wood products, 20% was used for plywood, and 12% for pulp. All roundwood demanded for pit prop was supplied domestically, while all roundwood demanded for plywood were imported. Of roundwood used for local pulp production, 71% was imported and 29% was supplied domestically. About 90% of the roundwood used for producing sawnwood and other wood products was imported, and only 10% was supplied domestically. As a whole it can be seen that producing sawnwood and other wood products for domestic use led the roundwood market in the Republic of Korea.


Total
(9,328)
11%
89%
Domestic
(1,062)
Import
(8,266)
100%
Domestic
(1,062)
100%
96%
Domestic
(7,925)
4%
Export
(341)
100%
100%
10% 104(100%)
35% 367(29%)
12% 886(71%)
20% 1,611(100%)
55% 591(10%)
68% 5,428(90%)
100%
23% 79
77% 262
Pit prop
(104)
Pulp wood
(1,253)
Plywood
(1,611)
Sawnwood & others
(6,019)
Plywood
(79)
Sawnwood & others
(262)
(1%)
(14%)
(18%)
(67%)
(23%)
(77%)
12%
(100%)
88%
(100%)
Domestic
(8,987)
Export
(341)
(96%)
(4%)
(100%)
Total
(9,328)
Supply
Demand

(   ) : Thousand cubic meters

Figure 10. Market flow of roundwood in Republic of Korea in 1997(unit: 1,000 cubic metres)

Import of wood products

In Figure 11 an obvious shift in imports from roundwood towards high-priced wood products can be seen. Starting in 1991, the increasing trend of roundwood importation turned to a slightly decreasing trend. In contrast, imports of wood products such as plywood and sawnwood have tended to increase steadily since the mid-1980s with its volume exceeding the volume of roundwood imported since 1988. While imported log volumes in 1997 were almost the same as those in 1990, importation of wood products has increased by about 39% from 1990 to 1997. Increasing importation of wood products has been accompanied by a prohibition of log exports in producer countries (KFRI 1997b).

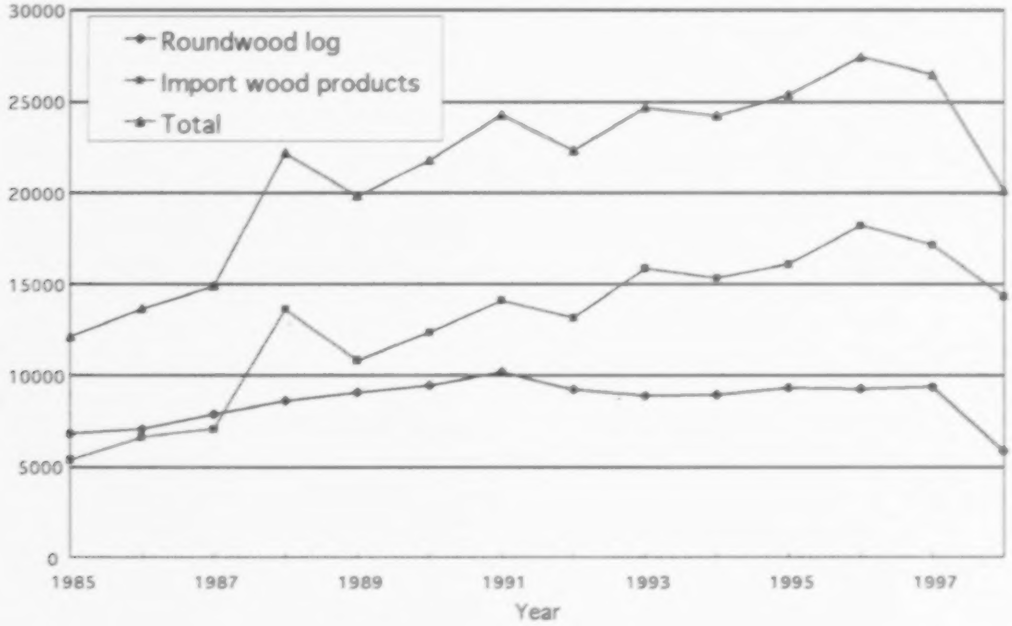


Figure 11. Volumes of roundwood and wood products imported to the Republic of Korea (1985-1998)

Characteristics of roundwood market in Korea

The timber market of the Republic of Korea can be characterized by (1) import-oriented supply and (2) domestic-oriented demand. Import patterns have also changed as follows: (3) from hardwood to softwood, (4) from high to low quality, and (5) from roundwood to wood products. These five characteristics indicate that the Republic of Korea is a country that imports wood-based raw materials and faces difficulties in sustaining a supply of roundwood through both domestic production and imports. As one of the world's wood-material consumer countries, the Republic of Korea would not like to have a reputation as being a country causing the deforestation of tropical forests with the associated harmful effects on global environment. It is therefore very important for the Republic of Korea to stabilize its supply of wood-based materials, especially roundwood, without destruction to either domestic or foreign forests.

Strategies for sustainable timber supply in industry

The view that exports of roundwood are being curbed by producer countries motivates wood-based companies in the Republic of Korea to invest directly in tropical and sub-tropical countries. Plantations of fast-growing hardwood species are being established by several wood-based companies to meet anticipated increases in the demand for wood-based materials as a long-term means to cope with a shortage of raw material (KFS 1999). To date, approximately 270 000 forest concessions have been acquired from seven countries and a total plantation area of about 32 000 ha has been established with such fast-growing species as *Acacia mangium* (Vietnam), *Eucalyptus* (Australia, Solomon Islands), and *Pinus radiata* (New Zealand) by several companies (Table 2).

Table 2: Establishment of plantations in tropical and subtropical countries by several companies (ha)

Year	Australia	New Zealand	Solomon	Vietnam	Indonesia	China	Sum
1993	508	-	-	-	-	-	508
1994	1,000	-	-	498	-	-	1,498
1995	854	-	413	1,124	-	-	2,391
1996	2,248	504	1,796	956	1,150	-	6,654
1997	2,035	1,515	2,016	1,000	510	-	7,076
1998	1,400	1,300	2,010	1,786	1,100	150	7,746
1999	2,013	1,000	1,513	-	577	1,250	6,353
Sum	10,058	4,319	7,748	5,364	3,337	1,400	32,226

Source: KFS (1999).

Strategies and supports for sustainable timber supply by government

The Republic of Korea, a major log-consuming country, has made efforts to stabilize the supply of wood-based raw materials with various support policies. One of those policies is to support the establishment of plantations in tropical and subtropical countries. This is primarily aimed at ensuring a sustainable supply of wood materials. The Korean government also aims to gain a reputation as a country that contributes to preserving the global environment.

From an economic viewpoint, roundwood production from plantations in tropical and subtropical countries is considered more profitable in relation to cost, price and yield. For example, the planting cost of radiata pine in plantation would be only one-third of the planting cost for *Pinus koraiensis* in the Republic of Korea and five times the volume could be yielded with the same rotation period of 30 years (KFS 1999). The price of roundwood from plantations established by Korean companies in tropical and subtropical countries would be 40–60% of the price of imported roundwood (KFS 1999).

Various projects to promote the establishment of plantations have been carried out by the Korean government. According to the Korea Forest Service (1999), about 1 million ha of plantation are planned to be established by 2050, and about 50% of the roundwood demand in the Republic of Korea will be met by wood materials produced in the plantations (Table 3).

Table 3. Long-term plan for log supply in Republic of Korea

	1997	2010	2020	2030	2040	2050	Unit
Plant. Area[1]	32	334	534	734	936	1 000	1 000ha
Log supply (%)	9 328(100)	30 746(100)	35 348(100)	38 559(100)	40 531(100)	42 043(100)	1 000m^3
Domestic	1 062 (11)	3 234 (10)	4 635 (13)	6 844 (18)	9 486 (23)	12 574 (30)	1 000m^3
Import	8 266 (89)	23 312 (76)	22 295 (63)	19 315 (50)	14 645 (37)	8 669 (21)	1 000m^3
Plantation	-	4 200 (14)	8 400 (24)	12 400 (32)	16 400 (40)	20 800 (49)	1 000m^3

[1] Plantation area overseas

Source: KFS (1999).

Support system

In establishing plantations, there are basic principles proposed by the government. Fast-growing tree species would be favoured, and countries located geographically near to Korea would be preferred over more distant countries. In any case, political safety of investments must be secured; therefore the political stability of partner countries plays an important role in the decision-making process prior to investment. To ensure the security of investments, a number of security pacts with partner countries have been concluded. Forestry Pacts with Indonesia, Russia, New Zealand, Australia, China, Vietnam, and Myanmar have been concluded, and forestry pacts with other countries are planned (KFS 1999).

The safety of economic investment is also a very important principle in decision making. It is important for investors in foreign countries to have accurate information on partner countries. False information or lack of reliable information hinders the success of investments. Thus political, economic, social, and cultural information on partner countries has been compiled by Forestry Research Institute and distributed to investor companies. In recent years, reports on the investment environment of several countries such as Malaysia, Vietnam, Myanmar, New Zealand, Australia, Solomon Islands, Papua New Guinea, Chile, and China have been issued (KFS 1996; KFRI 1994, 1996, 1997a, 1998a, 1998b). In these reports, the political and economic situations, information on forest resources and forestry, infrastructure, laws and institutions related to forest, and incentives for investment are detailed.

Conclusion

It is not anticipated that the domestic supply of roundwood in the Republic of Korea will improve enough to meet the needs of roundwood in the near future. The current demand for roundwood will inevitably rely upon imports for some time to come. In view of environment concerns, importing wood materials in the form of roundwood will be more difficult. In the long run, the Korean government needs to make efforts to improve its own forest resources and to diversify its log imports from overseas. As a method for meeting the needs of environmental protection while stabilizing the supply of wood-based materials, Korean companies and government have decided to establish fast-growing plantations overseas .

References

Korea Forest Research Institute (KFRI). 1994. Opportunities for softwood plantation forestry investment in Chile, New Zealand, and Australia. Research Report 82. 171 pp.

KFRI. 1996. Opportunities for hardwood plantation forestry investment in Malaysia, Solomon Islands, and PNG. Research Report 117. 123 pp.

KFRI. 1997a. Opportunities for forestry investment in China. Research Report 135. 117 pp.

KFRI. 1997b. Current demand and supply of timber in Korea, Research Report 133. 124 pp.

KFRI. 1998a. Forestry policy and investment environment for forestry and wood industries of China. 132 pp.

KFRI. 1998b. Annual report on forestry economy, Research Report 140. 296 pp.

Korea Forest Service (KFS). 1996. Environment for forestry investment in overseas., 275 pp.

KFS. 1999. Statistical Yearbook of Forestry 29. 522 pp.

KFS. 1999. Plantation in overseas. http://www.foa.go.kr/2003_forest/eng/html/poli/poli_023.htm

A linear programming approach to evaluating criteria and indicators for sustainable forest management in Japan

Takuya Hiroshima

Laboratory of Forest Management, Department of Forest Sciences,
Graduate school of Agricultural and Life Sciences, The University of Tokyo
1-1-1 Yayoi, Bunkyo-Ku, Tokyo 113-8657, Japan
Tel: +81-3-5841-5201, Fax: +81-3-5841-5429, E-mail: hiroshim@fr.a.u-tokyo.ac.jp

Abstract

Thresholds of criteria and indicators accepted in the Montreal Process were estimated using a linear programming method. The thresholds consist of the «feasible region» and the «optimum value». First, four criteria were picked up and indicators were tentatively defined for each criterion. Next, the constraints of the indicators to meet the requirements for sustainable forest management were formulated using the linear programming model. The constraint applied was that the indicators are non-declining over the planning horizon to ensure sustainable forest management. Finally, the thresholds of the indicators were estimated by a method of parametric linear programming. The results show that the estimated thresholds reflect a trade-off relationship between the criteria. It was concluded that the concept of threshold is effective in evaluating progress toward sustainable forest management.

Keywords: *Criteria and indicators, Japan, linear programming, sustainable forest management, threshold.*

Introduction

Background

After the 1992 United Nations Conference on Environment and Development in Rio de Janeiro (the Earth Summit), several initiatives have listed sets of criteria and indicators (C&I) for sustainable forest management (SFM) in the main forest zones around the world. For its part, Japan participated in the Montreal Process, 1995, for temperate & boreal forest zones, and developed its own C&I to monitor SFM.

In Japan data on the C&I corresponding to traditional forestry activities such as yield, volume and growing stock have been collected using national statistics. Today, data related to other, less traditional C&I are being collected. For instance, the indicators associated with biodiversity, soil and water resources and ecosystem health are intensively monitored in a couple of model forests although there are some difficulties in aggregating data at a regional or nation-wide scale. Japan is now in its final stage of collecting C&I data through these activities and method is now required to evaluate them.

In other countries, a number of studies have been conducted to evaluate SFM using C&I. One distinguished study was produced by the World Wide Fund for Nature (WWF) in 1998. The main points of this document can be summarized as follows: 1) the "desired values" for the indicators are considered; 2) the

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

gaps between these values and the indicator values being monitored are investigated; 3) scores are given to the indicators based on the investigations of the gaps (of course, smaller gaps bring higher scores); and (4) the scores are aggregated and the progress toward SFM is evaluated by the total score (WWF 1998). The key point of this evaluation system is to determine the desired values, set strategically in this case. For a proper evaluation, it is necessary to estimate the desired values—namely the thresholds—while analyzing long-term changes in the indicators.

Objective

The objective of this study was to estimate the thresholds of C&I using a linear programming method. This paper is organized as follows. First, some criteria are selected and the corresponding indicators tentatively defined. Next, the constraints of the indicators to meet the requirements for SFM are formulated using the linear programming model. Finally, the thresholds of the indicators are estimated by a method of parametric linear programming. Note that, in this study, an emphasis is put on the methodology of estimating the thresholds and that the numerical values shown in the figures are tentative only.

Materials and methods

Selection of C&I for the study

For simplification, only four criteria relating to "biological diversity", "productive capacity", "carbon cycles" and "socio-economic benefits" are considered in this study. The corresponding indicators, "area of old-growth forests", "growing stock of commercial forests", "total growing stock of forests" and "harvesting volume", are then tentatively defined for the criteria respectively (Hiroshima *et al.* 1996, 1997). Generally, 'old-growth forests' have a greater variety of species compared with younger forests: this means that the total area of 'old-growth forest' can be considered an easy-to-monitor indicator of biodiversity on a nation-wide scale in Japan. The growing stock of commercial forests is traditionally regarded as an important indicator of a forest's productivity. The total growing stock of the forest is a basic indicator to evaluate the carbon stock in the forests. Total harvesting volume is a basic indicator for the economic aspect of forestry. All of the indicators were assumed to be relevant at the national level. Necessary data were obtained from Japan's national statistics.

Overview of a linear programming method

Linear programming is a method designed to find out an optimum strategy for conducting productive activities under resource restrictions. It is often used for solving management problems.

In the field of forest science, the method has been applied mainly in forest planning. In Japan, the pioneer study was conducted by Nagumo and Minowa (1967), who constructed the linear programming model for a sustained yield of timber. In recent years, the method has been flexibly developed into a goal programming approach for optimizing the multiple uses of forests (Sano and Sakamoto 1998) and fuzzy programming (Nogami 1991). These models can incorporate the concept of SFM by optimizing the multiple forest functions such as timber production and wildlife protection. However, to the author's knowledge, the use of the linear programming with regard to SFM and C&I has never been reported.

Procedures for solving a problem by using linear programming are generally as follows: 1) activities are defined as decision variables; 2) resource-oriented restrictions (or requirements) on the activities are formulated as constraints; and 3) from the feasible region satisfying the constraints, the optimum solutions that maximize (or minimize) the objective function as a management goal are found.

Among these procedures, the set of the feasible region and the optimum solutions agrees with the concept of threshold. To construct the model for obtaining the thresholds of C&I, the following procedures are taken: 1) the harvesting activities are defined as decision variables; 2) the requirements for SFM that C&I should satisfy are formulated as constraints; and 3) the feasible regions and the optimum solutions of the indicators satisfying the constraints are considered the threshold.

Structure of the model

The model presented here deals with total forest area in Japan to estimate the thresholds of indicators at the national level. The pre-requisites of the model are as follows: 1) the forests are divided into four groups; private plantation forest, national plantation forest, private natural forest, and national natural forest; 2) the planning horizon is 10 terms (1 term = 5 years), and; 3) age is broken down into 17 classes (1 class = 5 years).

Adopting the idea that cutting area is determined in order to maximize total harvesting volume over planning horizon (Nagumo and Minowa 1967), the objective function is formulated with the decision variables as follows:

$$Max \sum_{g=1}^{4} \sum_{t=1}^{10} \sum_{a=1}^{17} (V_{g.a} X_{g.t.a} + T_{g.a} Y_{g.t.a})$$

(1) where:

$V_{g.a}$ = final cutting volume per area by group and age class (a constant),

$X_{g.t.a}$ = final cutting area by group, term, and age class (a decision variable),

$T_{g.a}$ = thinning volume per area by group and age class (a constant), and

$Y_{g.t.a}$ = thinning area by group, term, and age class (a decision variable).

The constraints mainly consist of the requirements for SFM. Although the concept of SFM is interpreted in many ways, in this study the fundamental requirement for SFM is that all of the indicators are non-declining over the planning horizon. Furthermore, the thresholds should be determined based only on the initial conditions of the indicators, so that no equation concerning the specific upper-limit or lower-limit values of the indicators is formulated in the model.

Key constraints concerning SFM

The constraints related to biological diversity are that the area of old-growth forest is non-declining over the planning horizon. This is formulated as follows:

$$\sum_{g=1}^{4}(AR_{g.t.17} - AR_{g.t+1.17}) \leq 0 \quad t = 1,2,\ldots,10$$

(2) where:

$AR_{g.t.a}$ = area of forests by group, term, and age class (an accounting variable).

Old-growth forests are defined as the forests with an age class of 17 and above. The reason why t includes 10 is that the area of old-growth forest after the planning horizon, i.e., $AR_{g.11.17}$, is to be analyzed.

The constraints related to productive capacity are that the area of commercial forest is constant over the planning horizon. The non-declining policy is not applied to this criterion, because in Japan commercial forests have such a large growing stock that it is desirable to decrease it.

The constraints related to the carbon cycles are that the total growing stock of forests is non-declining over the planning horizon. This is formulated as follows:

$$\sum_{g=1}^{4}\sum_{a=1}^{17}(G_{g.a}AR_{g.t.a} - G_{g.a}AR_{g.t+1.a}) \leq 0 \quad t = 1,2,\ldots,10$$

(3) where:

$G_{g.a}$ = growing stock per area by group and age class (a constant).

Carbon dioxide is sequestrated into trees as the growing stock increases according to the equation (3).

The constraints related to the socio-economic benefits are that the harvesting volume is non-declining over the planning horizon and does not increase by more than 10% from the preceding harvest. This is formulated as follows:

$$\sum_{g=1}^{4}\sum_{a=1}^{17}(V_{g.a}X_{g.t.a} + T_{g.a}Y_{g.t.a} - V_{g.a}X_{g.t+1.a} - T_{g.a}Y_{g.t+1.a}) \leq 0 \quad t = 1,2,\ldots,9$$

(4-a)

$$\sum_{g=1}^{4}\sum_{a=1}^{17}(V_{g.a}X_{g.t+1.a} + T_{g.a}Y_{g.t+1.a} - 1.1V_{g.a}X_{g.t.a} - 1.1T_{g.a}Y_{g.t.a}) \leq 0 \quad t = 1,2,\ldots,9$$

(4-b)

Without the upper limit on the increment of the harvest, the solution would be that harvesting is restrained in the early stage and implemented intensively only at the final period because the objective function is to maximize the harvesting volume. This will result in an extreme increase in the indicators, which is not desirable in terms of SFM. To counter this problem, the harvesting volume at the first period has to be given.

$$\sum_{g=1}^{4}\sum_{a=1}^{17}(V_{g.a}X_{g.1.a}+T_{g.a}Y_{g.a.a})=150_{(\text{million m}^3)}$$

(5)

The amount of periodic timber supply (150 on the right-hand side) represents Japan's situation based on the national statistics of 29.0 (million m^3/year) in 1996. Thus, the harvesting volume does not fall below 150 (million m^3/term) (= 30 million m^3/year) when considering both the equations (4-a) and (5) together.

In addition to the above-mentioned constraints related to SFM, the model includes other equations such as cutting regulations, forest transition, and so on.

Estimation of the thresholds

As mentioned above, the thresholds consist of the feasible region and the optimum solution. The thresholds change as time passes because the indicators are described by the function of t as follows:

Area of old-growth forests: $\sum_{g=1}^{4} AR_{g.t.17} \quad t=1,2,\ldots,10$

Growing stock of commercial forests: $\sum_{g=1}^{4}\sum_{a=1}^{17} CR_{g.t}G_{g.a}AR_{g.t.a} \quad t=1,2,\ldots,10$

Total growing stock of forests: $\sum_{g=1}^{4}\sum_{a=1}^{17} G_{g.a}AR_{g.t.a} \quad t=1,2,\ldots,10$

Harvesting volume: $\sum_{g=1}^{4}\sum_{a=1}^{17}(V_{g.a}X_{g.t.a}+T_{g.a}Y_{g.t.a}) \quad t=1,2,\ldots,10$

where:

$CR_{g.t}$ = the ratio of commercial forest area by group and term (a constant)

The optimum solutions are found with the objective function value of 34.0 (million m^3/year) according to the constraints mentioned above.

In order to find the feasible regions of the indicators, it is common to search corner-points of feasible solutions by adopting the simplex method (Danzig 1963). It is technically difficult, however, to apply the method to the model with thousands of variables and constraints. In this study, therefore, the feasible regions are found by the application of the parametric linear programming method (Gass 1969). There have been some related studies in the past. For example, Amano and Nishizawa (1975) apply the parametric method to analyze the relationship between the annual allowable cut and the total yield over the planning horizon in Japanese plantation forests.

To seek the feasible regions, the optimum solution values are given to the indicators by the new equations and the values are changed to find out the region where the feasible solutions exist. To illustrate, the procedures to find the feasible region of the total growing stock of forests are as follows.

First, the equation (6-a) is added to the linear programming model.

$$\sum_{g=1}^{4}\sum_{a=1}^{17} G_{g,a} AR_{g,11,a} = R1$$

(6-a)

This equation represents the total growing stock of forests after the planning horizon, and the optimum value is given to $R1$.

Next, the objective function value decreases as $R1$ is increased from the optimum value, 4.41 (billion m^3), and no feasible solution exists when $R1$ reaches 4.86 (billion m^3). This means no solution satisfies both the equations (4-a) and (5), because the value of the harvesting volume falls below 150 (million m^3 / term) when $R1$ equals more than 4.86 (billion m^3). If $R1$ is decreased from the optimum value, no feasible solutions are found when $R1$ reaches 4.35 (billion m^3). Consequently, it is found the feasible region of the growing stock after the planning horizon is between 4.35 and 4.86 (billion m^3) (see Figure 1).

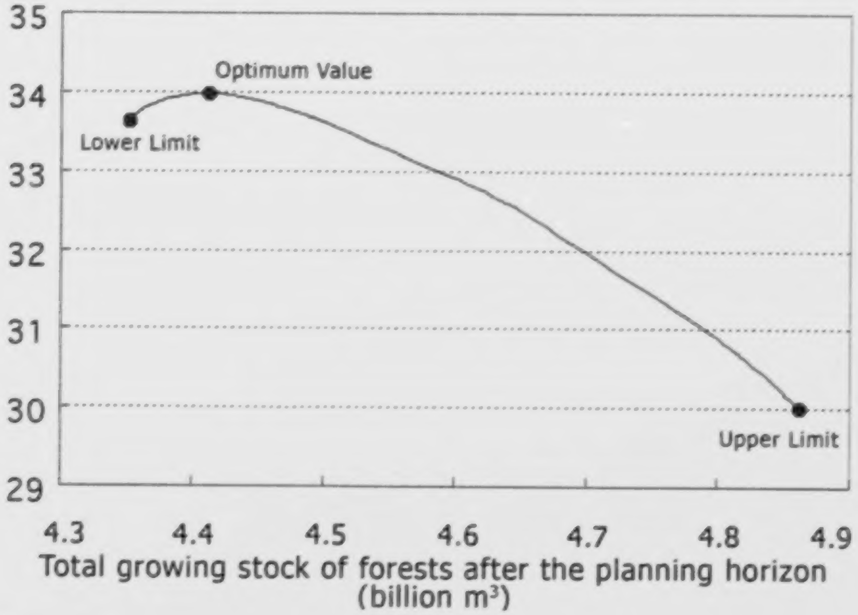


Figure 1. The relationship between the total growing stock of forests after the planning horizon and the objective function value. The objective function value is converted into the annual average.

The growing stock in the preceding period changes according to the change of the growing stock after the planning horizon, which can be regarded as the feasible region of the growing stock from the first period to the final period. In other words, all of the feasible solutions in the preceding period can be found by changing the feasible solutions after the planning horizon from the optimum value to the upper/lower limit value, because the indicators are connected in time series (Figure 2).

Thus, putting all of the feasible solutions over the planning horizon together, the feasible region of the growing stock is settled (Figure 2). The feasible region becomes broader as time passes because the choices of the solutions become wider in the latter stage of the planning horizon.

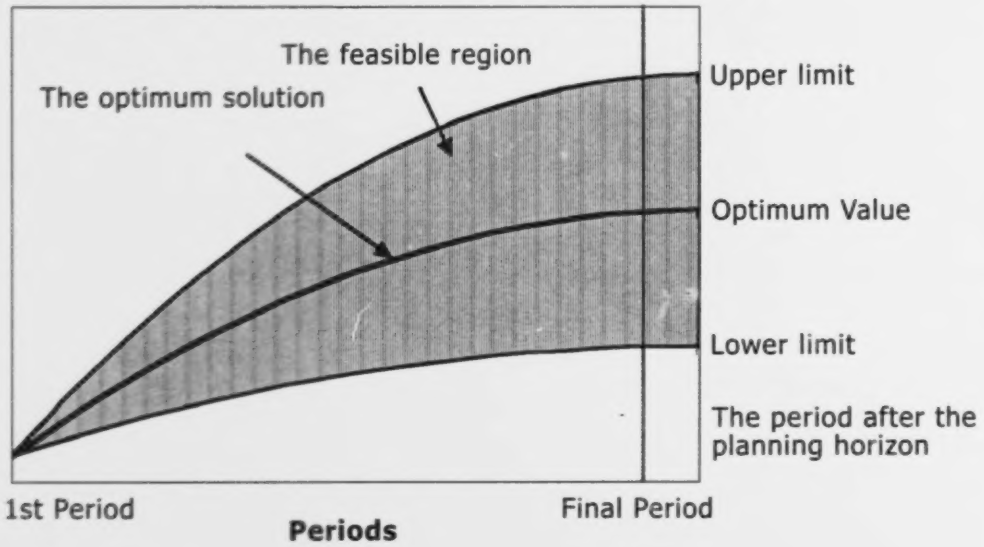

The feasible region
The optimum solution
Upper limit
Optimum Value
Lower limit
The period after the planning horizon
1st Period
Final Period
Periods

Figure 2. The relationship between the value of the indicator after the planning horizon and the threshold. The hatched area and the bold curved line represent the feasible region and the optimum solution, respectively.

In the cases of the area of old-growth forests and harvesting volume, the following equations are respectively added to the model instead of Equation (6-a).

$$\sum_{g=1}^{4} AR_{g,11,17} = R2$$

(6-b)

or

$$\sum_{g=1}^{4}\sum_{a=1}^{17}(V_{g,a}X_{g,10,a} + T_{g,a}Y_{g,10,a}) = R3$$

(6-c)

The feasible regions of these indicators can be found by using the same method with the total growing stock of forests.

In the case of the growing stock of commercial forests, the feasible region is obtained by subtracting the growing stock of non-commercial forests from the total growing stock of forests.

Results and discussion

The estimated feasible regions and optimum solutions of the indicators are shown in Figure 3. In the model, the feasible regions mean the range where the indicators satisfy the requirements for SFM. The optimum solutions mean the values of the indicators that maximize the harvesting volume that satisfies the requirements for SFM over the planning horizon. These definitions are particular to the model, so the meanings of both feasible region and optimum solution vary according to constraints and objective function.

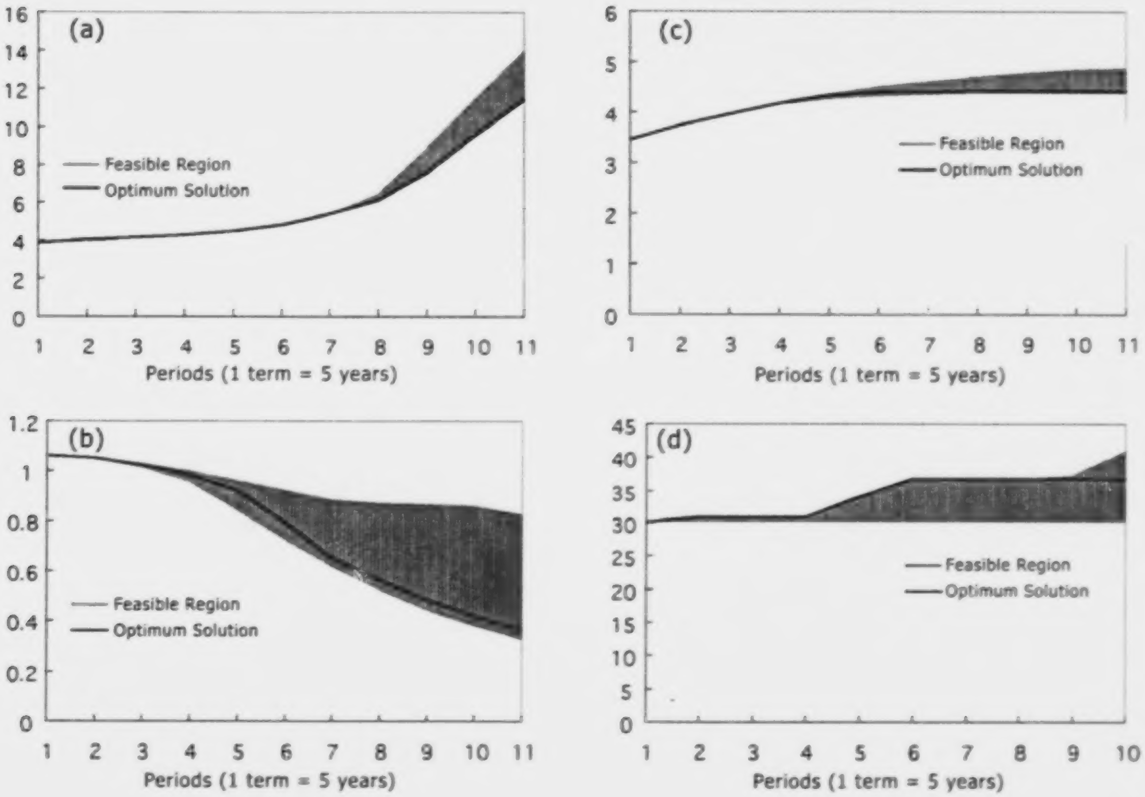


Figure 3. The estimated feasible regions and optimum solutions of the indicators: a) Area of old-growth forest; b) Growing stock of commercial forests; c) Total growing stock of forests; d) Harvesting volume.

With regard to the area of old-growth forest (Figure 3a), the optimum solution agrees fairly with the lower limit of the feasible region throughout the planning horizon. This means that old-growth forests are cut to maximize harvesting volume.

In the case of the growing stock of commercial forests (Figure 3b), the optimum solution is close to the lower limit of the feasible region over the planning horizon. This means that middle-aged or old-growth forests are cut intensively to gain yields. Since the non-declining policy is not applied to this indicator, the indicator value is allowed to decrease.

For the total growing stock of forests (Figure 3c), the optimum solution is close to the lower limit of the feasible region over the planning horizon. The increase in this indicator is derived from the increase in the growing stock of non-commercial forests while the growing stock of commercial forests decreases.

For the harvesting volume (Figure 3d), the optimum solution agrees with the upper limit of the feasible region until the final stage of the planning horizon because the objective function is to maximize the yields.

The feasible regions and optimum solutions are determined concerning the balance among four criteria. The harvesting volume reflects the trade-off relation toward the other three indicators because only the harvesting volume corresponds to "activity" and the other three corresponds to "resource" in the model. Actually, the optimum solution in Fig.3d closes on the upper limit of the feasible region while the ones in Fig.3a, 3b and 3c lie near the lower limit. This tendency considered, if the harvesting volume exceeds its feasible region, the other three indicators should fall beneath their feasible regions. In other words, because activities and resources are in the relation of cause and effect, if the harvesting volume falls within its feasible region, the other three indicators will also fall within their feasible regions.

To evaluate the progress toward SFM, it is important to check the relationships between the indicator value, the feasible region and the optimum solution. If the value of the indicator falls within its feasible region, it is supposed that the conditions required for SFM are fulfilled for that indicator. Furthermore, it is better if time-series changes in the indicator approach the optimum solution.

Conclusion

In this study, the methodology of evaluating C&I for SFM using linear programming was developed. The key factor of the methodology was the thresholds that consist of the feasible regions and the optimum solutions of the indicators. The meaning of the feasible region was the mathematically calculated range where the indicators should satisfy the conditions of SFM. The meaning of the optimum solution was the best value of the indicators in the feasible region. The study was conducted in the following steps. First, some criteria were assigned tentative indicators designed to consider the Japanese forestry circumstance. Next, the conditions required for SFM were formulated as constraints using the linear programming method, and the optimum solutions were found. Finally, the feasible regions of the indicators were estimated using the method of parametric linear programming. The results show that the estimated thresholds reflect the trade-off relationships between the criteria. The model developed in this study had a very simple structure with only four C&I used for simplicity; nonetheless, the methodology developed could be applied to more generalized cases with many C&I. It was concluded that the concept of the threshold is effective in evaluating progress toward SFM.

References

Amano, M. and Nishizawa. 1975. Calculation of sustained yield by the method of parametric linear programming. Transactions of the Japanese Forestry Society, No.86, pp. 45-46. (in Japanese)

Danzig, D. P. 1963. Linear Programming and Extension. Princeton University Press, Princeton, New Jersey. 764 pp.

Gass, S. I. 1969. Linear Programming – Methods and applications. McGraw-Hill, New York. 358 pp.

Hiroshima, T.; Amano, M.; Ogiwara, H. 1996. Treatment of the environmental preservation on the Timber Supply-Demand Model. Transactions of the Japanese Forestry Society, No.107, pp. 69-72. (in Japanese)

Hiroshima, T.; Amano, M.; Ogiwara, H. 1997. Evaluation of criteria and indicators concerned with the forest planning system in Japan. Transactions of the Japanese Forestry Society, No.108, pp. 115-118. (in Japanese)

Nagumo, H.; Minowa, M. 1967. Analysis of the Regulation of Yield by Linear Programming. Bulletin of the Tokyo University Forests, No.63, pp. 235-265.

Nogami, K. 1991. Forest management planning and fuzzy goal programming. Journal of Japanese Forestry Society, Vol.73, No.1, pp. 34-39.

Sano, M.; Sakamoto, T. 1998. Examination of making watershed management plan considering various viewpoints for land use. Journal of Japanese Forestry Society, Vol.80, No.2, pp. 120-128

World Wildlife Fund (WWF). 1998. European forest scorecards 1998. WWF European Policy Office, Brussels. 382 pp.

Inclusion before streamlining: the status of data collection on Aboriginal issues for sustainable forest management in Canada

Peggy Smith

Senior Advisor
National Aboriginal Forest Association

Abstract

This paper focuses on the status of data collection on Aboriginal issues for sustainable forest management (SFM) in Canada. In particular it considers the Canadian Council of Forest Ministers criteria and indicators, the Canadian Standards Association and Forest Stewardship Council forest certification systems, and some Aboriginal-led initiatives. The work of the National Aboriginal Forestry Association (NAFA) in criteria and indicators, certification, and Aboriginal forestry initiatives is used as an assessment filter. The author has been a senior advisor to NAFA since 1991. This assessment is based on the assumption that to ensure that SFM criteria and indicator measurement processes are fair, effective, and efficient, it is first necessary to ensure that Aboriginal people are included in the process. Some possible steps in streamlining local-level information may lead to policy decisions that are inefficient, ineffective, and unfair by focussing the discussion on making the measurement of indicators more efficient by involving fewer people, which would make data collection a technical exercise. This may also involve rolling up indicators and thereby removing the recognition of the unique role of Aboriginal peoples at local levels. This paper argues that social equity in the form of recognition of the unique role of Aboriginal peoples has not been addressed and full information is not available because the particular knowledge and values of Aboriginal peoples are lacking. If this is the case, then sustainable forest management cannot be achieved.

Keywords: *Criteria and indicators, sustainable forest management, Canada, forest certification, National Aboriginal Forestry Association, Aboriginal and treaty rights, Aboriginal values, forest management planning*

Introduction

Canada is among a few countries in the world that includes recognition of Aboriginal peoples in its national constitution. The recognition of Aboriginal and treaty rights is enshrined in *The Constitution Act, 1982*, in Section 35. Since 1982 this constitutional recognition of Aboriginal and treaty rights has been slowly filtering through federal and provincial government legislation and policy. The constitutional recognition of Aboriginal peoples is recognition of their original occupancy of the country now called Canada and their way of life based on historical land-use patterns. It is also recognition of their unique status, way of life and values.

In the forest sector, the recognition of Aboriginal and treaty rights and the commitment to increased Aboriginal participation have been recognized as essential elements of sustainable forest management

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

(SFM) in Canada (Smith 1998). This commitment is documented in Canada's National Forest Strategy (NFS) (NFSC 1998), which was renewed in 2003 with a reduction in the number of commitments contained, but with Aboriginal issues remaining prominent in the draft strategy, and in the Canadian Council of Forest Ministers (CCFM) criteria and indicators (C&I) of SFM (CCFM 1995) (see Appendix). The commitment to Aboriginal participation is also listed in the principles for two forest certification systems used in Canada since 1993: the Canadian Standards Association (CSA) and the Forest Stewardship Council (FSC). However, practice does not always match policy, and efforts, both to implement these commitments and to measure the success of their implementation, need improvement.

This paper focuses on the status of data collection on Aboriginal issues as part of SFM in Canada, in particular the CCFM C&I, the CSA and FSC forest certification systems and some Aboriginal-led initiatives. The work of the National Aboriginal Forestry Association (NAFA) is used as an assessment filter. The author has been a senior advisor to NAFA since 1991. This assessment is based on the assumption that to ensure that SFM criteria and indicator measurement processes are fair, effective, and efficient, it is first necessary to ensure that Aboriginal people are included in the process.

Aboriginal involvement in the Canadian Council of Forest Ministers criteria and indicators of SFM

The National Aboriginal Forestry Association (NAFA) is an Aboriginal-controlled non-profit organization founded in 1991 to provide a national voice for greater Aboriginal participation in the forest sector, in C&I, certification, and Aboriginal forestry initiatives. NAFA became involved in the development of the CCFM C&I in 1993 as a member of the technical committee that drafted the six criteria approved by the Forest Ministers in 1995. NAFA promoted the idea that both the recognition and protection of Aboriginal and treaty rights and increased Aboriginal participation in the forest sector should be considered essential elements of forest management. NAFA also argued that these issues were important enough to warrant their own separate criterion and encouraged the Canadian federal and provincial governments to take a leadership role in the international arena by demonstrating their commitment to Aboriginal peoples (Bombay *et al.* 1995). As a result, at the beginning of the CCFM C&I development, a seventh criterion on Aboriginal peoples and SFM was considered. However, some of the provincial ministers that were members of the CCFM argued against having a separate Aboriginal criterion, but agreed that the two important concepts of Aboriginal rights and participation would be recognized under Criterion 6: Accepting Society's Responsibility for Sustainable Forest Management. The recognition and protection of Aboriginal and treaty rights became enshrined in Element 6.1 and Aboriginal participation in Element 6.2. The following are the indicators chosen to measure the status of these two elements (CCFM 1995):

6.1.1 Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights.

6.2.1 Extent of Aboriginal participation in forest-based economic opportunities.

6.2.2 Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural, or spiritual sites.

6.2.3 Number of Aboriginal communities with a significant forestry component in the economic base and diversity of forest use at the community level.

6.2.4 Area of forest land available for subsistence purposes.

6.2.5 Area of Indian reserve lands under integrated management plans.

While it is important that these principles were recognized in the CCFM C&I, NAFA contended that their relegation to the broad social Criterion 6 had minimized the importance of Aboriginal issues in forest management and contributed to a lack of commitment in measuring and assessing progress toward meeting those commitments. NAFA has continued to promote the idea that giving Aboriginal issues the prominence of a separate criterion would increase the level of government and stakeholder commitment to addressing Aboriginal issues in forest management and focus attention on finding ways to measure, monitor, assess and, most importantly, improve the implementation of its commitments to include Aboriginal peoples in forest management.

Forest certification systems and Aboriginal participation

NAFA has also been involved in the development of the two Canadian forest certification systems by FSC and CSA. These market-driven, voluntary systems assess forest companies against extra-governmental standards for SFM developed through multi-stakeholder processes. They have expanded the field of criteria and indicators relevant to forestry in Canada and are providing both direction and information that can be used to measure progress on Aboriginal issues in forest management.

NAFA was involved in the development of the CSA's CAN/CSA Z808 and Z809 standard, approved in 1996, as well as the development of regional standards for the FSC. These certification systems, especially the FSC's, have acted as an incentive for both government and industry to improve their current regulations and operations. While certification raises questions about who holds the ultimate responsibility for forest management, it is becoming more obvious that certification is a driving force in setting forest management standards beyond those required by government (Hoberg 1999). This is particularly true in the case of Aboriginal issues where reluctance on the part of provincial governments to share jurisdictional authority for forest management has often hampered co-operative agreements with Aboriginal peoples. However, not all certification systems are alike.

NAFA withdrew from CSA in 2002 during a mandatory review of the standard because of its adoption of the CCFM C&I as a framework, remembering that the CCFM C&I had subsumed Aboriginal issues under the broader social criterion rather than creating a separate Aboriginal criterion. In a letter to the CSA, NAFA (Rekmans 2002) cited its main reason for withdrawal as: "The Combined Standard, CAN/CSA Z808/809-2001 Sustainable Forest Management Requirements and Guidance Document, does nothing more than commit to recognizing Aboriginal and treaty rights as they are currently interpreted by provincial forest management legislation and regulations. The CSA standards offer Aboriginal people nothing more than a promise to comply with what is already an insufficient approach to addressing Aboriginal rights."

Another reason cited by NAFA for withdrawal focussed on the issue of indicators. The CSA SFM elements prohibit the possibility of establishing specific Aboriginal indicators by placing unmanageable conditions on how indicators will be selected. This creates some difficulty for Aboriginal people when it comes to identifying forest values, which at times may be intangible and not easily defined by current scientific methods. According to the standard the selection of indicators should be consistent with scientific understanding of the value being described and technically valid (objectively obtained documented comparable, and reproducible). This creates a great deal of difficulty for Aboriginal people who operate mostly on the basis of traditional ecological knowledge rather than scientific approaches.

The CSA review resulted in a revised standard, CSA Z809-02 (CSA 2002a). This standard takes a limited view of the treatment of Aboriginal and treaty rights, especially when it comes to the obligation of companies to address these issues in their forest operations. While calling for special efforts to involve Aboriginal peoples based on their unique legal and historical status, the standard goes on to say that it is up to governments to deal with Aboriginal and treaty rights (CSA 2002a). The CSA process requires forest companies to involve the public in the determination of planning goals and the development of local-level indicators to ensure continual improvement. However, it must be noted that some First Nations have engaged in the CSA process and found the system to be adequate to address their concerns (West Islands Woodlands Advisory Group 2002).

The FSC in Canada has developed indicators through regional standards. FSC deals with Aboriginal issues under its Principle 3, Indigenous Peoples Rights, which includes the following criteria:

3.1 Indigenous peoples shall control forest management on their lands and territories unless they delegate control with free and informed consent to other agencies.

3.2 Forest management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples.

3.3 Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers.

4.4 Indigenous peoples shall be compensated for the application of their traditional knowledge regarding the use of forest species or management systems in forest operations. This compensation shall be formally agreed upon with their free and informed consent before forest operations commence.

Source (FSCC 2003)

In the development of regional standards, the FSC committees have attempted to localize the application of their broad principles and criteria on indigenous rights. To better inform the development of standards in British Columbia (BC), where, in most areas, treaties had not been negotiated with the Crown, a legal opinion on the application of Principle 3 was commissioned. Stevenson and Peeling (2000), the authors of the opinion, summarized how standards should address indigenous rights in forest management in BC:

> To conform to the principles of international law and a fair and meaningful interpretation of Principle 3, the regional standards setting process should:
>
> - Use an expansive definition of "lands and territories" that conforms to the definitions in ILO Convention 169 and the UN Draft Declaration on the Rights of Indigenous Populations;
> - Reflect that Principle 3 sets a higher standard than does domestic law in Canada because it shifts the onus away from Aboriginal peoples to prove their rights;
> - Ensure that certifiers don't simply assume that the existence of a treaty process in British Columbia and a set of elaborate consultation guidelines means that domestic law is being conformed with;
> - Insist that the BC Ministry of Forests consultation guidelines do not be used to establish the threshold for Principle 3;
> - Require that Indigenous control of their lands and territories be through formal co-management agreements that are not merely elaborate consultation guidelines;
> - Be vigilant in ensuring the "informed consent" is actually acquired in order to avoid skullduggery and sharp dealings, and;

- Be purposive in approach to reflect that the degree of "control" required or amount of disclosure contemplated for "informed consent" may vary with the degree of connection to the land.

Stevenson and Peeling's opinion and its implications for FSC standards development have informed discussions on the application of Principle 3 not only in BC but also within FSC Canada and FSC International. With the development of an FSC national boreal standard in Canada, a further legal opinion from Peeling was commissioned to address the issue of treaty rights within the boreal region. In that opinion, Peeling (2002) reiterated the earlier opinion, in particular the points above, and, in addition, gave direction on lands where both historic and modern-day treaties had been negotiated. These included:

1. The right might be a direct right to the trees. In modern treaties forestry is often dealt with specifically.
2. The right might be a residual right of Aboriginal title. This sort of right was dealt with in R. v. Peter Paul, [1997] N.B.J. No.439 where Paul was charged with unlawful cutting of timber on Crown lands without the Minister's authority.
3. The right might be a right incidental to a specific Treaty right such as illustrated by the case of R. v. Sundown where it was held that a Treaty right to hunt encompasses the right to build shelters as a reasonable incident to that right.
4. The right might be another right dependent upon the health of the forests. For example, a hunting right is dependent upon the ability of the land to sustain animals. Damage to that environment indirectly causes damage to the Treaty right.

The local application of FSC Canada principles and criteria in the draft national boreal standard (FSCC 2003) has led to standards that may provide further direction on indicators for the protection of indigenous rights. Forest Stewardship Council Canada standards are helping to clarify legal interpretations of the meaning of Aboriginal and treaty rights in forest management and are providing a way to assess the protection of those rights by forest companies.

The current state of data collection on Aboriginal indicators by the CCFM

Data that bears on Aboriginal land use and participation in the forest sector is poor. Baseline data is often non-existent. Until such data are available, it is impossible to get a full understanding of the impact of industrial forest operations on Aboriginal communities or to get a measure of the true value of Aboriginal subsistence or commercial activities. This is particularly true for non-timber uses and the protection of those values that forest managers now recognize as uniquely important to Aboriginal peoples, including cultural and spiritual sites. The CCFM has reflected on the inadequacy of the data available since it set in place its criteria and indicators of SFM and began to attempt to measure compliance with these commitments (CCFM 1997, 2000).

In 1997 the CCFM released the *Criteria and Indicators of Sustainable Forest Management in Canada Technical Report* on its "present ability to measure the forest values that Canadians want to sustain and enhance." At that time it was recognized that the governments' ability to measure and report on Aboriginal issues in forest management was very poor. The report describes it this way:

> The CFS [Canadian Forest Service] has collected data regarding on-reserve forestry activities for the past 10 years, but with the exception of British Columbia, the provinces have collected such information only sporadically. Since the creation of NAFA in 1991, several studies have highlighted Aboriginal participation in these activities, while a number of other Aboriginal organizations have surveyed their membership for information on business and economic opportunities. Coordination among federal and provincial governments and Aboriginal organizations is needed for the collection and assessment of this type of data.
>
> *Source CCFM 1997*

With the release of the *Criteria and Indicators of Sustainable Forest Management in Canada National Status 2000* report three years later (CCFM 2000)—"a first attempt to report on sustainable forest management"—not much changed. Two problems were apparent in the report. One was government's reliance on its own data to assess compliance with Elements 6.1 and 6.2 on Aboriginal issues. The second was the inadequacy or lack of available data.

For Element 6.1 on Aboriginal and treaty rights, the report pointed to the importance of "clear property rights and use, in conjunction with the assurance that these rights will be recognized through due process" and described the difficulty in measuring compliance because of "changing interpretations of those rights and evolving forms of co-management." To measure compliance, the CCFM carried out a survey of provincial and territorial governments (CCFM 2000). This is a good example of a biased data collection method. If an indicator is measuring compliance with Aboriginal and treaty rights, or any other Aboriginal indicator, does it not make sense that Aboriginal groups and people involved in forest management would also be surveyed to assess their understanding and degree of satisfaction with these indicators? Governments and Aboriginal peoples have very different interpretations of the meaning of Aboriginal and treaty rights. Even the interpretation of legal decisions on the meaning of these rights will be very different, with Aboriginal peoples wanting a broader interpretation and governments a narrower one. Only through jointly defining indicators and balanced data collection from all affected parties will a meaningful measure result.

The reports for each indicator for Element 6.2, Aboriginal participation, told the same story. The extent of Aboriginal participation in forest-based economic opportunities, Indicator 6.2.1, stated: "comprehensive national data are not available" and "the only data collection that does take place is on an ad hoc basis." For Indicator 6.2.2—the extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites—the report said that "it is not possible to comprehensively report," but then went on to use the measure of the number of reserves with integrated forest management plans, never justifying how this measure relates to the protection of unique sites. As of 2003, only 286 Aboriginal communities of a total of 610 had management plans, of which only 138 incorporate social values, only 104 cultural values, and a meagre 40 spiritual values. There is still no means to measure whether these values are taken into account in forest management planning off-reserve.

Indicator 6.2.3—the number of Aboriginal communities with a significant forestry component in their economic base and diversity of forest use—used data collected by Aboriginal Business Canada (an arm of Industry Canada) and Statistics Canada to draw the conclusion that only seven of 750 Aboriginal Census Subdivisions were found to be forest-dependent. Given that approximately 80% of Aboriginal communities are within the commercial forest region of Canada, common sense belies this conclusion. Obviously something is awry with the "economic base method" used to come up with this measure. The report did acknowledge that other studies show that "dependence on the forest is greater than typically captured by forest industry dependence measures" (Korber 1997, cited in CCFM 2000).

For Indicator 6.2.4— the area of land available for subsistence purposes—once again there was "insufficient information to report on the area of forest available for subsistence purposes.... To date no agency or institution has systematically tracked this information" (CCFM 2000). The poor state of and lack of progress in data collection in all of the indicators under Elements 6.1 and 6.2 begs the question: How will forest managers adequately measure Aboriginal participation in forest management?

At the time of writing, the CCFM C&I were undergoing a review with a May 2003 draft available. This document outlined the goal of the review as the improvement of the relevance and efficiency of the indicators (CCFM 2003). In a May 2003 letter to the Minister of Natural Resources NAFA withdrew from the C&I review process stating:

> NAFA is of the view that these Criteria and Indicators do not advance the concepts of sustainable forest management as they do not accommodate the unique position that Aboriginal people have in Canada nor do they respect the significance of Aboriginal or treaty rights within forest management, nor the legal duty to comply with the constitution.
>
> *Source: Ginnish 2003*

The May 2003 draft of the CCFM C&I recommended the reduction of the original 83 indicators to 53 after an assessment of:

- relevance to the criterion;
- measurability based on scientifically valid, empirical measurements that can be consistently repeated over time, with data that are both practical and fiscally feasible to collect;
- understandability, not only to forest managers, but also to an informed public;
- ability to be forecast into the future with reasonable accuracy, and;
- whether or not reference values could be determined for the indicator.

Given the challenges described within the CCFM technical progress reports of 1997 and 2000, and using the review-assessment criteria, it seems the direction of the CCFM C&I will be to further reduce emphasis on or eliminate entirely the more difficult-to-measure Aboriginal indicators. However, taking such steps would not erase the challenge of addressing Aboriginal and treaty rights in forest management or increasing Aboriginal participation in the forest sector. Better social science methods and the involvement of Aboriginal peoples in data collection would be a more effective approach to addressing these challenges.

Aboriginal models for data collection

Many Aboriginal communities have catalogued their land-use patterns and resources in traditional land-use and occupancy studies, modelled on the first such study, *Inuit Land Use and Occupancy Project* (Milton Freeman Research Ltd. 1976). These studies have been carried out to support land claims, provide evidence for legal cases defining Aboriginal rights (Hopwood *et al.* 1993) and as a basis for negotiations with land-use planners. A recent practical guidebook to traditional land-use planning, *Chief Kerry's Moose: A Guidebook to Land Use and Occupancy Mapping, Research Design, and Data Collection*, brings together the author's experience of "nearly two decades of experience designing land use and occupancy mapping projects and working with indigenous peoples at the community level to collect the data they need" (Tobias 2000). Although there is valuable evidence in such land-use studies, the information has not been applied adequately to forest management nor has it been collected in such a way as to be compatible with existing forest inventories. If a standard format for transmitting and storing data is ever agreed to by a broad group of users, it would have to be planned jointly with Aboriginal representatives, ensuring that adequate technical and financial resources are available to Aboriginal organizations to participate in the data collection. Other guidebooks are also being published (especially in BC) that reflect the increasing importance of incorporating Aboriginal values in forest management planning. This also reflects the efforts of non-governmental organizations to assist Aboriginal communities in building their capacity to participate in provincial forest management planning (Hopwood 2002, Collier *et al.* 2002, Karjala *et al.* 2003).

Two models of Aboriginal planning for sustainable forest management have been described in the NAFA report, *Aboriginal Forest-Based Ecological Knowledge in Canada* (Bombay *et al.* 1996). The Algonquins of Barriere Lake (ABL), under a trilateral agreement signed in 1991 with the Province of Quebec and the Government of Canada, have been working to "analyze existing data and information and compilation of new inventories and information on renewable resource use, potential uses, impacts and interaction of development activities within the perimeter of the Agreement territory, and preparation of a draft integrated resource management plan for renewable resources and recommendations for carrying out the draft plan" (Bombay *et al.* 1996). After 10 years, the ABL have completed their integrated resource management plan (IRMP) and are ready to discuss its implementation with the Province of Quebec and forest companies operating in their territory. Some of the social indicators that the Algonquin stipulate for their planning area are: 1) distribution of resource benefits & revenues; 2) level of land-use conflict; 3) level of community satisfaction with IRMP process; 4) participation of ABL in decision making process; 5) ABL & scientific databases; 6) the area of land and quality of resources for subsistence and cultural purposes; 7) the level of land alienation; 8) Algonquin values documents and maps used in decision-making process; 9) the protection of cultural and heritage sites, and; 10) the level of societal and economic benefit (Diabo 2001).

In BC, the Gitxsan are applying their ecological knowledge through a Statistical Watershed Analysis Team (SWAT). They are *"completing a landscape level analysis of the watershed which graphically illustrates the composition, structure and function of the landscape"* (Bombay *et al.* 1996), as well as inventorying cultural resources, enhancing the resolution of existing information in forest-cover base maps and developing tools that will allow them to participate in forest management planning.

Both of these models, and several additional ones, such as the recent ecosystem-based management approach of the Innu in Labrador (Innu Nation 2003), illustrate Aboriginal leadership in data collection and management.

Aboriginal users as environmental monitors

There is a need for Aboriginal leadership in areas of data collection that directly affect Aboriginal rights and land use, including subsistence and commercial forest activities. This is especially important for non-timber uses such as hunting, fishing, trapping and gathering, sacred and culturally significant sites, and economic benefits to local communities. As well, Aboriginal land users can play a key role in monitoring and evaluating local forest conditions and in implementing forest management plans. One trapper recently asked the question: Why would forest companies and the government want trappers off the land? Who else will be able to watch what is going on? Aboriginal land users can play a unique role as "forest guards" whose observations are based on intimate knowledge of local conditions and an ongoing connection with forest-based activities.

Conclusion: building a new relationship

Probably even more than other social indicators, as difficult as they are to measure, the measurement of Aboriginal indicators is itself a reflection of the exclusion and misunderstanding of Aboriginal peoples in forest management. Until Aboriginal peoples become part of the process to measure, collect, and monitor indicators, and until government agencies are willing to make the commitment to jointly address the problems and methods in collecting data on Aboriginal peoples, fair, effective, and efficient indicators will remain elusive. Given the absence or exclusion of Aboriginal peoples from forest management planning, practice, monitoring, evaluation, and improvement, current discussions about streamlining local-level information become a red flag, warning that such efforts might serve to solidify an unjust situation. If priorities must be established, then let the planners and decision-makers—with their Aboriginal counterparts—redress the issues of exclusion before moving on to streamlining.

References

Canadian Council of Forest Ministers (CCFM). 1995. Defining Sustainable Forest Management: A Canadian Approach to Criteria and Indicators. Ottawa: Canadian Forest Service, Natural Resources Canada. 22 pp. (http://www.ccfm.org/3_e.html) July 2003.

CCFM. 1997. Criteria and Indicators of Sustainable Forest Management in Canada Technical Report. Ottawa: Canadian Forest Service, Natural Resources Canada. 22 pp. (http://www.ccfm.org/3_e.html) July 2003.

CCFM. 2000. Criteria and Indicators of Sustainable Forest Managmeent in Canada: National Status 2000. Ottawa: Canadian Forest Service, Natural Resources Canada. 22 pp. (http://www.ccfm.org/3_e.html) July 2003.

CCFM. 2003. CCFM C&I Review Draft Revised Indicators for Sustainable Forest Management For use in potential users' discussion meeting. Ottawa: CCFM C&I Secretariat. 18 pp.

Canadian Standards Association (CSA). 2002a. CAN/CSA Z809-02 Sustainable Forest Management: Requirement and Guidance. Toronto, ON. (http://www.csa-intl.org/onlinestore/GetCatalogDrillDown.asp?Parent=3268) August 2003.

Canadian Standards Association (CSA). 2002b. CSA's Sustainable Forest Management Standard CSA-Z809-2002 - Summary of Key Changes in the Revised 2002 Standard. (http://www.sfms.com/pdfs/SummaryofChangestoZ809-02Final1.pdf) August 2003.

Bombay, H.; Smith, P.; Angus, M. 1996. Aboriginal Forest-Based Ecological Knowledge in Canada. Ottawa: National Aboriginal Forestry Assoc. 55 pp. To order NAFA publications, see (http://www.nafaforestry.org/)

Bombay, H.; Smith, P.; Wright, D. 1995. An Aboriginal Criterion for Sustainable Forest Management. Ottawa: National Aboriginal Forestry Association. (http://www.nafaforestry.org/criterion/) 8 pp. + appendix.

Collier, R.; Parfitt, B.; Woollard, D. 2002. A Voice on the Land: An Indigenous Peoples' Guide to Forest Certification in Canada. Ottawa and Vancouver: National Aboriginal Forestry Association and Ecotrust Canada. 106 pp. (http://www.ecotrustcan.org/pubs/pubs.shtml)

Diabo, R.; Arbex Consultants. 2001. The Barriere Lake Trilateral Agreement: Measuring Social Indicators of Forest Management. Presentation to Indigenous Peoples and FSC Certification Conference, August 17-18, 2001, Ottawa. (http://www.fsccanada.org/IPforum/diabo_files/frame.htm) August 2003.

Forest Stewardship Council Canada Working Group (FSCC). 2003. National Boreal Standard, Draft 2.1 (http://www.fsccanada.org/boreal/pdf_document/draft2_1_Eng.pdf)

Ginnish, S. 2003. Letter to Honourable Herb Dhaliwal, Minister of Natural Resources, Government of Canada re: CCFM C&I Review—Draft Revised Indicators for Sustainable Forest Management, May 2, 2003. (http://www.nafaforestry.org/docs/dhaliwalletmay2003.pdf)

Hoberg, G. 1999. The Coming Revolution in Regulating our Forests. Policy Options. December 1999: 53-56. (http://www.irpp.org/po/archive/dec99/hoberg.pdf) Downloaded August 2003.

Hopwood, A.; Mactavish, J.; Moar, A.; Scott, G. and Smith, P. 1993. Aboriginal Forestry Training and Employment Review. Final Report, Phase 1. Prepared for the AFTER Committee and the National Aboriginal Forestry Association. Ottawa: National Aboriginal Forestry Assoc. 81 pp.

Hopwood, D. 2002. What Lies Beneath: Responding to Forest Development Plans: A Guide for First Nations. Vancouver, BC: Ecotrust Canada. 52 pp. (http://www.ecotrustcan.org/pubs/pubs.shtml) August 2003.

Innu Nation. 2003. Forestry in Nitassanin. (http://www.innu.ca/forest/forestindex.htm) August 2003.

Karjala, M.; Sherry, E.; Dewhurst, S. 2003. The Aboriginal Forest Planning Process: A Guidebook for Identifying Community-Level Criteria and Indicators. Prince George, BC: Ecosystem Science and Management Program, University of Northern British Columbia. 92 pp. (http://researchforest.unbc.ca/afpp/AFPPMain.htm) August 2003.

Korber, D. 1997. Measuring Forest Dependence: Implications for Aboriginal Communities. M.Sc. Thesis. Edmonton, AB: Dept. of Rural Economy, University of Alberta. (Unpublished M.Sc. thesis)

Milton Freeman Research Ltd. 1976. Inuit Land Use and Occupancy Project. 3 volumes. Ottawa: Indian and Northern Affairs Canada.

National Forest Strategy Coalition. 1998. National Forest Strategy 1998-2003. Sustainable Forests: A Canadian Commitment. Ottawa: Canadian Council of Forest Ministers. 47 pp. (http://nfsc.forest.ca/strategy.html) August 2003.

Peeling, A. 2002. Review of the Application of Principle 3 in the Boreal Forests subject to Treaties and Aboriginal Rights (of First Nations and Métis). Toronto, ON: FSC Canada. 102 pp. (http://www.fsccanada.org/pdf_document/legal_opinion_Final.pdf) August 2003.

Smith, P. 1998. Aboriginal and treaty rights and Aboriginal participation: Essential elements of sustainable forest management. Forestry Chronicle 74(3): 327–333. (http://www.fsccanada.org/IPforum/peggy.doc) Designing an FSC National Boreal Standards Process (http://www.fsccanada.org/IP_conference)

Rekmans, L. 2002. Letter to CSA re NAFA's involvement on the Technical Committee which is currently conducting a review of the Draft Standards, Combined Standard: CAN/CSA Z808-809-2001 Sustainable Forest Management Requirements and Guidance Document. 3 pp.

Stevenson, M.; Peeling, A. 2000. Legal memorandum regarding Principle 3 of the Forest Stewardship Council's (FSC) Principles and Criteria. http://www.fsccanada.org/pdf_document/stevenson.pdf

Tobias, T.N. 2000. Chief Kerry's Moose: A Guidebook to Land Use and Occupancy Mapping, Research Design, and Data Collection. Vancouver, BC: Ecotrust Canada and the Union of BC Indian Chiefs. 64 pp. The book is available free in pdf format at http://www.nativemaps.org/ANewTrail/ANewTrail.pdf , or a hard copy can be ordered from Ecotrust Canada. (A book review is available at http://www.nativemaps.org/books.html#ANewTrail)

West Island Woodlands Advisory Group. 2002. Advisory group calls for education & dialogue to strengthen co-operation in local forest sector. Press Release, May 22, 2002. http://www.wiwag.org/pdf/press_may22_02.pdf. August 2003. See also Lem, T. 2002. Involvement of Indigenous Peoples in Local Advisory Committees. Presentation to Forest Leadership Forum, April 25-27, 2002, Atlanta, Georgia. (http://www.forestleadershipforum.org/proceedings5.htm) August 2003.

Streamlining planning and reporting for sustainable forest management

John L. Innes[1], Bill Wilson[2] and Gordon M. Hickey[1]

[1]*Sustainable Forest Management Laboratory, Department of Forest Resources Management, Faculty of Forestry, Forest Sciences Centre, 2424 Main Mall, Vancouver, BC V6T 1Z4*

[2]*Canadian Forest Service, 506 West Burnside Road, Victoria, BC V8Z 1M5*

Introduction

Forest managers today are faced with many challenges. There are requirements for increasingly detailed planning, increasing numbers of regulations that govern that planning, and very specific requirements for reporting whether or not the planned activities have attained the norms associated provincially, nationally and internationally with sustainable forest management. At the same time, the technical skills that are required of a forest manager are increasing, ranging from 'hard' skills such as the use of geographic information systems to 'soft' skills such as communication, conflict resolution and facilitation. Frequently, a manager has to use a range of skills to resolve particular issues, some of which are unfamiliar. This creates pressure on the manager, and a frequent complaint is that there is insufficient time and resources to complete a project satisfactorily. This pressure is very real, but there is often potential to reduce the extent of the problem by combining different needs. For example, management plans are often required by both legislation and by certification; if they were coordinated, the planning would only have to be done once.

Given these problems and their costs, it is appropriate that forest managers, forest auditors and forest scientists combine their expertise to identify ways in which some of the overlaps can be reduced or, at the very least, methods can be standardized so that there is little or no duplication of effort. In British Columbia, this has, to a certain extent, been dealt with by the Forest and Range Practices Act (Government of British Columbia 2002), although a number of issues, such as the overlap between certification, compliance and effectiveness monitoring, remain unclear. Other jurisdictions are also struggling with this problem, and are attempting to increase the quality of forest management without inducing undue economic pressures on forest product companies.

A number of issues have been addressed in this report. These include data collection, timber supply and procurement, non-timber forest products and the criteria and indicators of sustainable forest management. All of these areas are changing rapidly, and this report therefore represents a snapshot in time. However, it has been of value to take stock of the progress made to date, and to examine possible future directions.

Data collection

One of the greatest problems associated with monitoring for sustainable forest management is the cost of collecting data. Without a clear plan, clear objectives, and a clear strategy for the interpretation of the monitoring data, the collection of data is largely pointless. In addition, suitable technology needs to be available for storage of monitoring data, and a suitable system has to be in place for ensuring quality of

International perspectives on streamlining local-level information for sustainable forest management: A selection of papers from a conference held in Vancouver, Canada, August 28 – 29, 2004. Innes, J.L., Hickey, G.M., and Wilson, B., eds. 2004. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC.

data. Given these requirements, it is hardly surprising that there are few useful and reliable monitoring systems designed to report on sustainable forest management.

One possibility is to integrate the data collected under a variety of different schemes. In most countries, there is a reliable National Forest Inventory in place: this forms the foundation of information about sustainable forestry. These data sets may take the form of at least two different types of indicators. In Finland, for example, Nikinmaa (2004) has described how the National Forest Inventory has been expanded since the early 1990s to include a variety of national indicators. These describe biodiversity in ecosystems, long-term economic profitability of timber production, non-timber products, and other forms of forest use. The Swiss National Forest Inventory has adopted a similar strategy (Brassel and Brändli 1999). The second type of indicator relates to the effectiveness of implementing sustainable forest management. This is a particularly complex approach, and there are very few examples reported in the literature (an example is provided by Kremsater *et al.* 2003).

The auditing of forest data is an area in which there is considerable room for streamlining. Most certification schemes now require third-party auditing, and there are requirements that the auditors be in some way accredited. This places less onus on government bodies to collect the same data, although there will always remain a problem associated with the credibility of the data regardless of who is responsible for its collection. In Finland, this is achieved through a clear separation between judicial processes and voluntary audits (Nikinmaa 2004). The quality of voluntary data collection has been enhanced through the use of either quality or environmental management systems, with international standards for the former being attained through the ISO 9000 series and for the latter through the ISO 14001 standard.

Timber supply

A key objective of data collection in forestry is to determine the current status of the forest resource. Such information enables predictions to be made of future timber supply, which in turn enable a determination of the level of sustainable timber harvest. In cases where the demand for timber exceeds local supply, imports have to be relied upon. In the Republic of Korea, a shortfall in local supply has prompted Korean companies and the Korean government to promote plantations overseas (Lee 2004).

Accurate information on the domestic demand and exports of forest products forms the basis for many decisions about harvest levels. While the development of an overseas timber supply can appear beneficial, considerable concerns have arisen over the nature of forestry in the countries where the timber is procured. This has resulted in restrictions in the way that certified companies can supplement their domestic supply with imports. For example, the American Forest and Paper Association's Sustainable Forestry Initiative places considerable emphasis on the sources of timber procured overseas (AF&PA 2004).

The example of the Republic of Korea (Lee 2004) shows how dynamic the overseas supply of timber can be. Major changes are occurring in global timber supplies, and the pattern of trade in 20 years will be very different to what it is today. This has considerable implications for the recognition of sustainable forest management practices in different jurisdictions: it is significant that certification organizations are increasingly looking outside their home jurisdictions in order to respond to these global challenges. A good example is the Pan-European Forestry Certification scheme, which originally started in Europe but is now extending its coverage beyond that continent.

Non-timber forest products

Generally, non-timber forest products (NTFPs) are very poorly accounted for in both national forest inventories and certification assessments (Mrosek and Balsillie 2004). The collection of information on NTFPs requires specialized techniques that do not readily lend themselves to the techniques used in, for example, national forest inventories. However, they are often an important component of the social and economic aspects of sustainable forest management, and information collection is therefore important. Some progress has been made in this field, but much remains to be done. In a jurisdiction such as British Columbia, efforts to provide better information in this area are hampered by the multiple tenures that exist for particular areas of land, making monitoring of many NFTPs beyond the responsibility of the forest manager.

Indicators

Indicators of sustainable forest management remain an important and active area of research. In some cases, this is because initial indicators were poorly formulated and their implementation was impractical. This is particularly true of social indicators, with indicators related to indigenous peoples being particularly difficult. Within Canada, the issue of whether or not forest management is addressing the rights of First Nations remains controversial, at least for provincial governments. A series of court decisions [e.g., *Haida Nation v. B.C. and Weyerhaeuser* 2002; *Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage)* 2002; *Taku River Tlingit First Nation v. Tulsequah Chief Mine Project* 2002] have clearly indicated that there are obligations to enter into meaningful consultations with First Nations over forestry issues, and these consultations must involve both government and industry. Forest licensees have realized this, and are increasingly entering into arrangements with First Nations that involve some form of benefits sharing. However, considerable dissatisfaction remains, and there is also considerable resistance to including these considerations into processes such as certification. For example, considerable concerns arose over the decision of the Canadian Council of Forest Ministers' criteria and indicator revision process not to include a new criterion addressing respect for First Nations' rights and title (Smith 2004).

While indicators are of interest to forest management, they are of little value to planning. This is because an indicator simply provides information on the status of a particular feature. Even a time series for a particular indicator may not be particularly helpful. To be useful, indicators need to be associated with thresholds. In some cases, thresholds are chosen based on expert knowledge. In other cases, a more systematic approach is taken, and Hiroshima (2004) has provided information on how linear programming can be used. Linear programming is widely used in forestry (Davis et al. 2001), particularly for harvest scheduling, but it also has applications for the definition of thresholds for indicators of sustainable forest management.

In the United States, forest managers are faced with a bewildering range of federal and state laws that impact on management activities. These vary significantly from state to state, with states such as California and Washington having many detailed regulations, and others, such as New Hampshire, having very few. There is, in addition, much decentralization of the forest administration, leading to a myriad of different data collection and storage mechanisms (Abee 2004). The U.S. has opted to use the Montreal Process as a unifying framework for the various aspects of sustainable forest management and has, in addition, recognized that no one agency can possibly be the responsible for all aspects of sustainable forest management.

Different certification schemes

A variety of certification schemes exist. However, these have shown rapid development over the past five years and, in the time between the workshop and publication of this volume, the situation has changed dramatically. In North America, three main certification schemes exist: the CSA Standard, the Sustainable Forestry Initiative standard and the Forest Stewardship Council standard. In Europe, the Pan-European Forestry Certification scheme is a major player, being responsible for ensuring that national certification schemes meet a minimum standard. There is increasing recognition that all these different certification standards are no longer in competition. Instead, each certification scheme offers its own advantages and disadvantages. It seems likely that less and less emphasis will be placed on these differences, and that the use of labels to describe forest products as being derived from sustainably managed forests will not progress much further. Rather, forest products will be 'guaranteed' by their sellers as being from sustainably managed forests, with the onus being on the seller to have a sound procurement policy. This, together with various forms of mutual recognition between certification schemes and simultaneous certifications to different standards by third-party auditors, will reduce the need for streamlining of certification schemes.

Conclusions

The papers presented in this volume represent a small subset of the papers presented at the 2000 conference. There have been large and very significant changes in forest policy since that time, and many of the studies that were presented in 2000 are no longer relevant and have not been included in this volume. Despite the time difference and the changes in forest policy, it is interesting that many of the same problems remain. There is still much uncertainty over the roles and responsibilities of different stakeholders in public forest management. The Province of British Columbia has yet to produce evidence to support its claims of having one of the best-managed forest estates in the world. No "State of the Forests" report has been produced for British Columbia, and both the national reports of the Canadian Council of Forest Ministers and the Canadian sections of the Montreal Process reports continue to suffer from a lack of data. In the meantime, certification has developed rapidly, reflecting the desire of forest managers to have their work recognized as being socially, economically and environmentally sustainable. The result is that many companies are moving ahead to government in presenting evidence that they are responsible land stewards. This trend seems likely to continue, but it will be important to ensure that a credible system of monitoring and reporting is established to underpin the universal aim of sustainable forest management.

References

Abee, A. 2004. Sustainable forest management: the application of criteria and indicator measurements in the United States Forest Service. In: International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B., eds. Canadian Forest Service, Victoria.

American Forest and Paper Association (AF&PA). 1993. (http://www.afandpa.org/Content/NavigationMenu/Environment_and_Recycling/SFI/SFI.htm)

Brassel, P. and Brändli, U.-B. 1999. Schweizerisches Landesforstinvetar. Ergebnisse der Zweitaufnahme 1993-1995. Swiss Federal Institute for Forest, Snow and Landscape Research Birmensdorf, and Paul Haupt, Berne.

Davis, L.S., Johnson, K.N., Bettinger, P.S. and Howard, T.E. 2000. Forest management to sustain ecological, economic, and social values. 4th edition. McGraw Hill, Boston. 804 pp.

Government of British Columbia Ministry of Forests. 2002. Forest and Range Practices Act (SBC 2002, c. 69). (http://www.for.gov.bc.ca/tasb/legsregs/frpa/frpa/frpatoc.htm)

Hiroshima, T. 2004. A linear programming approach to evaluating criteria and indicators for sustainable forest management in Japan. In: International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B., *eds*. Canadian Forest Service, Victoria.

Kremsater, L., Bunnell, F., Huggard, D., and Dunsworth, G. 2003. Indicators to assess biological diversity: Weyerhaeuser's coastal British Columbia forest project. Forestry Chronicle 79: 590-601.

Lee, W-K. 2004. Sustainable roundwood supply in the Republic of Korea. *In:* International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B., *eds*. Canadian Forest Service, Victoria.

Mrosek, T; Balsillie, D. 2004. Criteria and indicators for the sustainability of non-timber forest products and services at the local level: a case study at the Haliburton Forest & Wild Life Reserve Ltd., Ontario. *In:* International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B: *eds*. Canadian Forest Service, Victoria.

Niemann, T; Innes, J.L. 2004. Streamlining local-level information for sustainable forest management. *In:* International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B., *eds*. Canadian Forest Service, Victoria.

Nikinmaa, H. 2004. Data collection and auditing of sustainable forest management in Finland. *In:* International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B., *eds*. Canadian Forest Service, Victoria.

Smith, P. 2004. Inclusion before streamlining: the status of data collection on Aboriginal issues for sustainable forest management in Canada. *In:* International perspectives on streamlining local-level information for sustainable forest management: Information Report BC–X–400. Innes, J.L; Hickey, G.M.; Wilson, B., *eds*. Canadian Forest Service, Victoria.

Canadian Forest Service Contacts

For more information about the Canadian Forest Service, visit our website at
www.nrcan.gc.ca/cfs-scf/
or contact any of the following Canadian Forest Service establishments

① Atlantic Forestry Centre
P.O. Box 4000
Fredericton, NB E3B 5P7
Tel.: (506) 452-3500 Fax: (506) 452-3525
atl.cfs.nrcan.gc.ca/

Atlantic Forestry Centre – District Office
Sir Wilfred Grenfell College Forestry Centre
University Drive
Corner Brook, Newfoundland A2H 6P9
Tel.: (709) 637-4900 Fax: (709) 637-4910

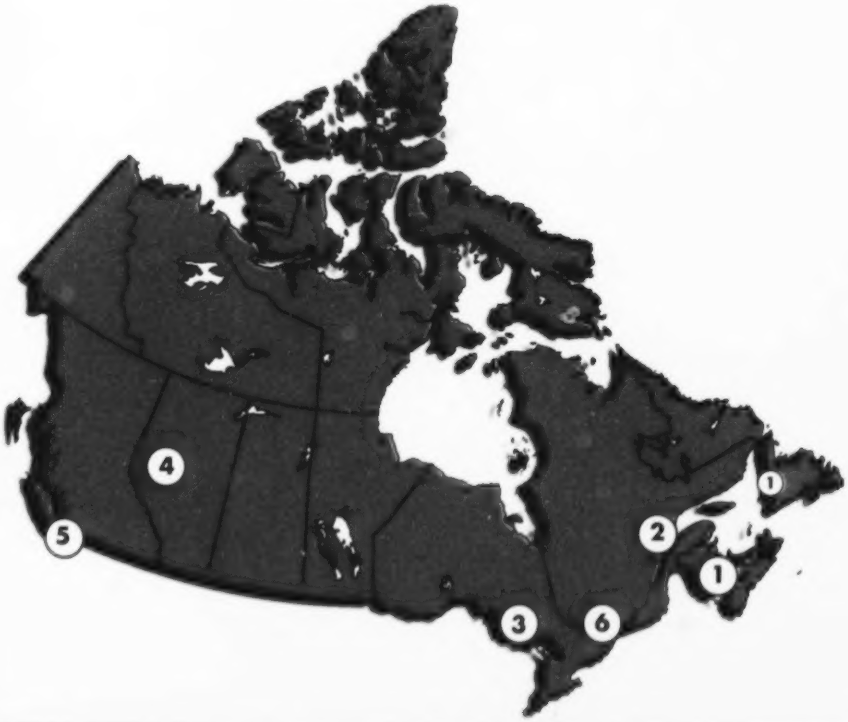
② Laurentian Forestry Centre
1055 rue du P.E.P.S., P.O. Box 3800
Sainte-Foy, PQ G1V 4C7
Tel.: (418) 648-5788 Fax: (418) 648-5849
www.cfl.scf.rncan.gc.ca/

③ Great Lakes Forestry Centre
P.O. Box 490 1219 Queen St. East
Sault Ste. Marie, ON P6A 5M7
Tel.: (705) 949-9461 Fax: (705) 759-5700
www.glfc.cfs.nrcan.gc.ca/

④ Northern Forestry Centre
5320-122nd Street
Edmonton, AB T6H 3S5
Tel.: (403) 435-7210 Fax: (403) 435-7359
nofc.cfs.nrcan.gc.ca/

⑤ Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5
Tel.: (250) 363-0600 Fax: (250) 363-0775
www.pfc.cfs.nrcan.gc.ca/

⑥ Headquarters
580 Booth St., 8th Fl.
Ottawa, ON K1A 0E4
Tel.: (613) 947-7341 Fax: (613) 947-7396
www.nrcan.gc.ca/cfs/



To order publications on-line, visit the Canadian Forest Service Bookstore at:
bookstore.cfs.nrcan.gc.ca